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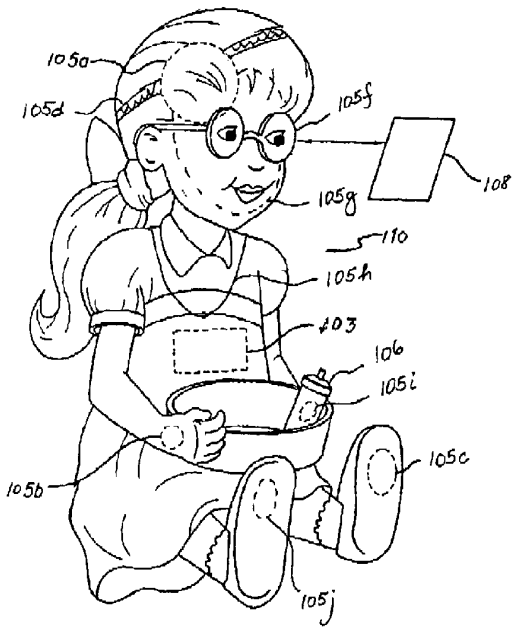

(57) Abstract: A toy or game play apparatus or method involving a powered host or master unit (103, 110, 120) which operates interactively with one or more nonself-powered play objects (108). The host has a preprogrammed microcontroller (213) and an RFID reader/interrogator circuit (207). Each play object (108) has a RFID tag IC (108a). When the host (103, 110, 120) and a play object (108) are positioned so as to afford RF communication between them, the host (103, 110, 120) sends power to energize the tag IC (207) of the play object (108). The host (103) recognizes that transmitted data and makes a presentation to the user caused by that transmitted data. Some or even all of the presentation may be the data from the play object (108).

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OBJECT RECOGNITION
TOYS AND GAMES

This application claims priority of copending U.S. provisional patent application Serial 60/335,908, which in its entirety is incorporated by reference herein.

FIELD OF THE INVENTION

This invention relates generally to toys and games, particularly to toys and games that identify objects.

BACKGROUND OF THE INVENTION

Toys are known which can respond to radio frequency (RF) signals, e. g., toy vehicles having radio frequency transmitting remote control units. Such toys typically respond to simple signals such as "forward," "stop" and "reverse." They require batteries in both the toy and transmitter.

RFID (radio frequency identification) transponder technologies are known in the prior art and used in retail store environments to sound an alert when products for which payment has not been made are removed from the premises, and in other detection systems such as automated toll-collection systems for highways, bridges and tunnels, e. g. "EZ Pass." While commercial RFID reader/interrogator circuits have been available in industrial systems such as in building access and security control systems, highway toll-taking systems such as EZ-Pass, Fast Trak,

and the likes, such circuits can cost from fifty dollars to several hundreds of dollars and thus are not suitable for use in a toy or game type product.

These commercial systems also involve a central or stationary fixed location RFID reader/interrogator detecting and recognizing items containing RFID tagged ICs, e. g. vehicles moving through toll gates using EZ Passes, customers filling in their gas tanks by waving RFID tagged cards, employees opening closed doors by waving RFID tagged security cards, books being checked in and out of libraries, etc. To obtain a large/long sensing and detection area in these systems, the associated antenna or energy and data-coupling element is generally larger than the RFID reader/interrogator chip.

RFID electronic components, "reader/interrogator" and "tag" circuits, are presently available in small, integrated circuit (IC) packages from several semiconductor vendors such as Philips, Motorola, Texas Instruments, Microchip, and Atmel, to name just a few suppliers.

U.S. Patents 6,361,396 and 6,364,735 disclose a method and apparatus, which allow one toy to identify a plurality of objects provided. The system relies on the inductive coupling of the toy with a resonant frequency tank circuit contained within the object to be identified. Physical contact between the toy and the object is not required.

The inventions disclosed in these two patents, however, have several limitations. One example is the total number of objects that the master unit can recognize, as well as the total number of objects that can be simulta-

neously recognized and distinguished, is limited. Furthermore, when dealing with multiple objects, a number of discrete frequencies in combinations have to be transmitted to be able to determine the sum/differences in frequencies to identify objects. Nor with the method of the above-mentioned patents can any information or changing or variable information, such as quantities, be written back to the object and stored for later recall, revisions, or can additional information be written or updated. This limits the play patterns and game play actions possible.

The game industry is always looking for ways to enhance game units and game/play patterns, while keeping the cost of production down. The present invention fulfills this need.

SUMMARY OF THE DISCLOSURE

In accordance with the disclosure, contactless or remote identification of objects by toy dolls and other toys can be achieved through the use of RF (radio frequency) transponders, commonly referred to and known to those skilled in the art as RFID Tag integrated circuits, "tag ICs," or "tags." A master/host/server toy or game unit (also herein referred to as "master unit") can identify and recognize something that is placed within range of the host without any physical or mechanical contact through the application of RFID technology. Objects to be recognized and identified by the master/host/server toy or game unit need only contain a small RFID tag transponder integrated circuit chip (tag IC) and a suitable RF antenna or energy and signal-information coupling element. Such

objects do not require a self-contained battery or other power source to be recognized. No optical code (e. g. bar code), invisible ink, ultraviolet or infrared ink is required, nor is mechanical or physical contact necessary between the recognizing toy and object to be recognized.

Tag ICs can respond differently from one another when interrogated by an appropriately programmed mas ter/host/server toy or game unit. The tag ICs transmit and receive information in the form of data bit streams to and from the master/host/server toy or game unit. The tag ICs receive their operating power from the RF energy transmitted by the master/host/server at the same time as data exchange occurs. The tag ICs do not require their own separate power source.

In addition to a toy or game master/host/server reading an object's identity from its tag IC chip, tag IC chips can receive information in the form of many digital bits written back and stored indefinitely in non-volatile digital or analog memory onboard the tag IC chip. This feature enables the creation of play substance quantitative and nonquantitative attributes such as in the form of kid's money, or a portable store of value, that can be held, transferred, traded, or otherwise exchanged with compatible devices, such as trading cards or "play money," which contain read/writeable RFID tag ICs containing non-volatile, electrically reprogrammable memory bits, utilizing appropriately programmed mas- ter/host/server toy or game units containing an RFID reader/interrogator circuit and suitable antenna. (The word "write" is used herein to also include rewrite and update. This write, rewrite, and update can be repeated a

number of times as required or designed by the game play or toy play-patterns.)

This feature, for example, also could be used with a doll to simulate consumption and replenishment of a resource, such as pretend milk in a toy milk bottle given to the doll. When a child presents a "full" milk bottle with an RFID tag IC inside it programmed as "full", then the doll can simulate drinking the milk, and the master/host/server can gradually reprogram the RFID tag IC in the milk bottle to be less and less full, as indicated by the setting of some selected data bits in the milk bottle RFID tag IC memory, via the rewriteable feature. When the milk bottle is "empty" the doll could possibly cry and ask for more milk. Then the toy milk bottle would have to be taken over to a different master/host/server toy, perhaps in the form of a cow or a dairy, so as to be "refilled" by way of having the selected data memory bits of the milk bottle RFID tag IC be reprogrammed accordingly.

A trading card, a game-playing card, a teaching flash card with visual information printed on it, a game-playing token, coin or piece of currency, or other small object can be provided with an embedded RFID tag chip and suitable antenna loop or coil, factory programmed with specific bits of read-only data in the tag IC memory. This card can be recognized by a talking doll, for example, that can then recite information about the card. The information can exceed that printed on the card and, for example, can contain secret information about the card that can only be accessed by a master/host/server toy or game unit. A doll can then recognize and recite information about the trading card. In other words, at

least some of the recited information may be stored on the card. Possibly most or even all of the recited information may be stored on the card. This can greatly minimize the requirement on the doll memory to store such recited information.

A tag IC with a suitable small antenna loop or coil can also be placed inside a small plastic figure, such as an action figure molded from plastic, that can be recognized by the doll or a reader device.

Such master/host/server toy or game units can play games such as spelling games, arithmetic games, shape and other recognition games, board games, duels games, battle games, wagering or betting games (e. g. betting on random or statistical behaviors for fun), and other games. Master/host/server toy or game units can be employed to recognize trading cards and other two and three dimensioned collectibles. A master/host/server toy or game unit can act on a tag IC in a collectible to change its data thereby selectively making it compatible or incompatible with other master/host/server toy or game units, thereby providing the ability to "catch" or "collect" a specific object or flash or trading card by a specific owner, after which it cannot be caught or collected by another, unless the owner agrees to trade it electronically to another owner, using the master/host/server toy or game controller.

Objects to be recognized and master unit toys may be in any two or three-dimensional form. Objects typically include things such as flash cards containing letters, numbers, words, pictures, animals, etc. Objects may also include miniature objects such as toy baby bottles, food items, common household objects, discs, tokens, pictures,

coins, currencies, houses, etc. Action figures, figurines, vehicles, animals may also be used as objects, as well as master unit toys.

In another aspect of the invention, an RFID reader/interrogator cartridge or accessory may be received, plugged into, and/or connected and operated by game/computing devices such as hand-held electronic game computing devices, PDAs (personal digital assistant), hand-held computers, tablet computers, and the like – for example, GAMEBOY and GAME BOY ADVANCE units from NINTEN-DO®, PALM™ hand-held computing devices from Palm, Inc., or iPaq hand-held computing devices from HP. Alternatively, the RFID reader/interrogator may be built-in into these game/computing devices.

The RFID reader/interrogator accessory is generally plugged into the game/computing device. The RFID reader accessory may also have an interface to accept and connect game cartridges or game packs, which contain ROM program(s) to operate the game or program with the RFID reader/interrogator accessory.

Game-play operations of these game/computing devices, e.g. video game or hand-held computing devices, generally involve reading information from RFID tag chips that are embedded in various objects or placed in objects at various locations. This reading of information may also involve modifying variable play substance values, such as adding power and points, or just generally enhancing the game play. These game-play operations may also be used for educational game purposes.

According to another aspect of the present invention, there is provided a gaming device comprising:

a hand-held game/computing device having a processor and an interface connector for removably receiving an accessory device;

at least one play object having at least one remote digital non-self powered radio frequency identification (RFID) tag chip, each RFID tag chip having a data storage;

an accessory device comprising (a) at least one RFID reader/interrogator chip operably connected to the hand-held game/computing device, and usable with at least one play object, (b) a receiving connector/interface operably and removably connected to the game cartridge/pack, and (c) one or more control circuits interfacing a game cartridge/pack and the hand-held game/computing device; and

a game/cartridge pack containing a play program comprising one or more program components, said play program being capable of controlling said hand-held game/computing device and the accessory device.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a perspective view of one type of toy which can serve as a master/host/server or master unit toy in accordance with a preferred embodiment of the invention;

Fig. 1B is a perspective view of another type of toy which can serve as a master/host/server toy in accordance with a preferred embodiment of the invention;

Fig. 2 is a functional schematic block diagram of a master/host/server toy and the play objects which it is intended to sense in accordance with a preferred embodiment of the invention;

Fig. 3 is a diagram showing orthogonal antennas in accordance with a preferred embodiment of the invention;

Fig. 4 is a schematic diagram of an exemplary circuit using four loop antennas and eight MOSFET transistors in accordance with an embodiment the invention;

Fig. 5 is a functional schematic diagram of an exemplary master unit that includes a voice/sound generator or synthesizer in accordance with an embodiment the invention;

Fig. 6 is a schematic diagram of an exemplary master/host/server toy that includes a visual display generator/controller in accordance with an embodiment of the invention;

Fig. 7A is an elevation view of another preferred embodiment of the invention;

Fig. 7B is a plan view of the preferred embodiment of the invention shown in Fig. 3A;

Fig. 7C is an elevation view of the preferred embodiment of the invention shown in Fig. 7A, with a modificatio

Fig. 8A is a front elevation view of still another preferred embodiment of the invention;

Fig. 8B is a side elevation view of the preferred embodiment of the invention shown in Fig. 8A;

Fig. 9A is a plan view of a hand-held game device with a radio frequency identification (RFID) cartridge and an exemplary play object to be recognized, constructed in accordance with a preferred embodiment of the invention;

Fig. 9B is a like view of Fig. 9A showing how a game cartridge, an RFID cartridge, and a hand-held device interconnect with each other;

Fig. 9C is a perspective view of a video game device master unit with a built-in RFID reader/interrogator in accordance with an embodiment of the invention;

Fig. 9D is a plan view of a hand-held computer, such as a PDA, with a built-in RFID reader/interrogator in accordance with an embodiment of the invention;

Fig. 10A is a flowchart to handle and process ownership and value information of play objects in accordance with an embodiment of the invention;

Fig. 10B is an exemplary master/host/server toy processing transfer of play objects — transactor, in accordance with an embodiment of the invention;

Fig. 11 is another embodiment of a toy or game with a master/host/server vehicle and a number of exemplary play objects, in accordance with an embodiment of the invention;

Fig. 12A is another embodiment of a toy or game with a master/host/server wand or hand-held unit and a number

of exemplary play objects, in accordance with a preferred embodiment of the invention;

Fig. 12B is another embodiment of the hand-held unit, wand, scanner, or waver of Fig. 12A in which the circuit elements of the RFID RI master unit are partitioned such that the antenna/energy and data-coupling element together with the RF circuit portions are in the hand-held portion and the remaining circuitry of the mater unit is in a separate section connected by a group of wires in a cable; and;

Fig. 12C is a like view of Fig. 12A but with the master/host/server interacting with a play object with a number of RFID tag ICs;

Fig. 13 is another embodiment of a toy or game with two exemplary master/host/server toys and a number of exemplary action figure play objects, in accordance with an embodiment of the invention;

Fig. 14A is yet another embodiment of a toy or game with a master/host/server tractor and a number of exemplary play objects, in accordance with an embodiment of the invention;

Figs. 14B through 14E illustrate how a master/host/server toy interacts with an exemplary play object, in accordance with a preferred embodiment of the invention;

Fig. 15 is yet other embodiments of master/host/server toys, in accordance with an embodiment of the invention;

Fig. 16 is yet another embodiment of a board game master/host/server interacting with coin play objects, in accordance with an embodiment of the invention; and

Fig. 17 is still another embodiment of a board game with a number of RFID tag IC and acting as a play object, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a first embodiment of the invention, RFID technology is used to make a doll appear to "see" flash cards or other objects, recognize them by name, and engage in play activity with them.

For example, in a "shape" game, the doll asks a child to show or give the doll a specific shape, such as "the blue square" or "the red triangle". The doll has a small loop antenna inside a hollow cavity in the chest area, so that as flash cards or objects are presented to the doll to "hold in its arms", a master/host/server toy or game unit program can detect them and respond with a voice in the appropriate manner. (Master/host/server is herein also referred to as master unit.)

Furthermore, the sensing coil or coils, or sensing antenna coupling elements of the master unit contained in the doll, can be located in different places, such as the head, or in a hand or foot, to localize the region where the target object will be detected. (Note that the embodiments of the invention are not limited to having coils as the only form of antenna or energy/signal coupling elements. Antennas can include a number of forms/elements, including, coils, loops of wire, or other conducting materials, plates, areas, surface, or other forms. The antenna and energy and signal information

coupling elements may also include capacitive coupling as well as inductive coupling means.)

In addition, the doll could include not just one, but multiple sensing antenna coils, located in various places on the doll, and which are switched on and off by control of the host microprocessor system. Such locations could include a coil in each hand of the doll, a coil in each foot, a coil in the doll's head, and a coil in the doll's abdominal cavity. Such a doll could play games with multiple objects, but might also play games with a single object by directing the user to sequentially position that object at different antenna, and recognizing and reporting back to the user as to the success or failure of each attempted positioning.

In conjunction with the selectively switching of the active antenna coil, the doll could ask the child to place a specific object in the doll's right hand, or in its left hand, for example. Utilizing a voice synthesizer, the doll can ask for specific shapes to be given to it, and then for them to be taken away, one at a time, with responses given as to whether each correct shape was provided.

It is also possible that more than one or all antenna be active simultaneously. This way a doll, for example, can ask for specific shapes to be handed to it. The shapes may be placed, for example, in either hands and still be recognized accordingly.

Objects presented to the doll can have numbers or spelling words which can be enunciated by an electronic voice synthesizer in the doll. The master unit can make animal sounds or other sound effects corresponding to a picture card or sculpture of a presented animal or other

sound effect such as a fire engine or motor car. The master/host/server or master unit may be provided with recorded or synthesized music for playing different songs and tunes, perhaps in different voices or with different sounding musical instrument sounds such as a trumpet or a flute, a violin or a trombone, and also with many different percussion sounds such as drums, bells, whistles, and other sound effects.

The master/host/server or master unit may also provide user presentations that are completely nonaudio. For example, visual presentation on a display, tactile presentation (e. g. vibrating master/host/server toy), and olfactory presentation may also be presented. The master unit, however, has to include appropriate components to handle such presentation. Audio and nonaudio presentations may also be combined.

In accordance with the disclosure, a doll or other master/host/server or master unit can remotely recognize and identify an object, flash card, token, or other thing with no physical or mechanical contact. The toy or doll or game can recognize just one thing at a time, or a multiplicity of many things at the same time (that is within a few hundred milliseconds of one another) by utilizing the so-called "anti-collision" feature of certain RFID tag ICs which are commercially available. Object detection in general is handled by one or more programs operating on microcontroller ICs in master units, in conjunction with RFID reader/interrogators.

Referring to Figs. 1A and 1B of the drawings, there are shown a girl doll 110 and a baby doll 120, respectively, each of which can contain an "engine" in the form of a master/host/server toy or game unit 103. In

addition to an integral antenna 105 located within the master/host/server toy or game unit (master unit) 103 mounted in the doll's chest cavity, another antenna 105a can be connected to the master unit 103 and mounted within the head of the dolls 110 and 120.

The characteristics of the antenna, such as number, placement, and shape, may vary depending on toy design. The dolls 110, 102, for example, may include additional antennas such as an antenna in an external hair band around the head 105d, inside the doll head and around the face area 105g, 105m, in either or both frames of the eyeglass 105f, in a necklace 105h, in either or both hands of the doll 105b, 105l, in either or both feet or shoes of the doll 105c, 105j, in the holder 105i, in the tummy 105k, etc.

Each of the dolls 110 and 120 is shown interacting with a play object 108. The girl doll 110 is interacting with one in the form of a card, while the boy doll 120 is interacting with one in the form of an action figure. Play objects, as well as master unit toys, may be in any two or three-dimensional form, such as bottles 106, trading cards, pictures, flowers, stuff dolls, lamps, grocery items (e. g. fruits, milk cartons, vegetables, etc.), vehicles, currencies, animals, etc.

The girl doll 110 may interact with a bottle play object 106 such that the bottle may be identified as full, half-full, or empty in a game or play pattern. It may also identify cards, such as identifying the shapes printed on the card. The boy doll 120 may identify and interact with various action figures according to the play

pattern program controlling the microcontroller or microprocesso:

Referring now to Fig. 2, there are shown a plurality of play objects 108 that each include a nonself-powered RFID transponder tag IC 108a and an RF antenna 108b. The play object may be, as discussed above, in any form such as a flash card, a trading card, or small object molded from a non-conducting, non-RF-shielded material.

The RFID tag ICs 108a are nonself-powered, in the sense, that they do not need their own power source, like a battery. They obtain their power from the master unit via inductive or capacitive coupling of sufficient energy using the antennas or energy coupling elements. No physical contact is required to convey the operating energy and power to the tag IC.

Radio signal communication of power and data to the play objects may be accomplished by various means, including inductive and/or capacitive coupling — primarily by magnetic and/or electric field components of the electromagnetic radio signal.

Fig. 2 also shows a master/host/server toy or game unit 103 (master unit) having an RF transmitting and receiving antenna sensing element or coil 105. This antenna may be of the primarily inductive coupling or primarily capacitive coupling type.

The master antenna element or coil 105 is tuned to the resonant operating frequency of the RFID tag ICs, and their associated antennas. The master antenna element or coils 105 are operatively connected to a reader/interrogator circuit 207.

The master/host/server or game unit 103 and the RFID tag ICs, regardless of the number of RFID tag ICs,

generally need to only communicate with each other using one fixed frequency. Because the RFID tag circuit operates at a single fixed frequency, the resonant circuit can be tuned for optimum Q, the quality factor, and thus perform with maximum energy coupling efficiency, which also reduces the amount of power required from the batteries or other power source to the master unit. The life of a battery or batteries in battery-operated toys thus may be extended as a result of the RF operation at one fixed frequency. Multiple frequency operation to communicate with more than one RFID tag ICs is unnecessary. Backup frequency, however, may also be implemented as part of the toy design.

The frequency of the radio signal can be at various standard frequencies used by the industry in standard components, including the one hundred twenty five (125) kHz (nominal) band, the thirteen (13) MHz (nominal) band, or other frequencies that may now be used or in the future by RFID technologies, such as fifty MHz, one hundred MHz, VHF, UHF, SHF, or SUFH frequency bands.

The circuit 207 transmits power to, and receives data transmitted from, the RFID tag ICs 8a within its range. The circuit 207 may also transmit data to the tag ICs. The play object 108 may typically be positioned about one to four inches from the master antenna 105, or possibly further. In certain play patterns, the detection range may be as minimal as one tenth of an inch to as many as twelve to twenty-four inches or more.

When the reader circuit 207 transmits energy to a tag IC, that tag IC uses the power to transmit its unique or identity data back to the circuit 207. The master unit 103 then uses that unique data to identify or "recognize"

that object 108. That unique data may be serial numbers. Thus, a card containing a picture of a horse can be distinguished from one containing a picture of a pig.

In one embodiment, each play object in a product line of toys is unique. This may be accomplished by having a unique piece of information associated with each play object within that product line. Serial numbers may be used. A smaller or larger collection of unique play objects may also be defined.

Serial numbers may be assigned and written in the RFID tag ICs during the manufacturing process. In one embodiment, a range of serial numbers or a particular serial number is assigned to an entity, such as apples. Thus, when a serial number within this range or that particular serial number is read from an RFID tag IC, the master unit accordingly and appropriately recognizes this object as an apple.

In another embodiment, serial numbers are not used, but rather a different identification information is used. In this embodiment, a set of ASCII data is stored to identify that object. For example, if the object is an apple, the ASCII equivalent of the word "apple" is stored in the RFID tag IC. When that object is detected, the identification information, in this case, "apple" is read. The master unit accordingly recognizes this object as an apple. This ASCII information may also be used by a text-to-speech synthesizer to say the word "apple." Serial number and identification information may both be used in an object.

It is also possible that data is not unique to a set of play objects. For example, it is possible that in the play-pattern or game, there are two red cards, and are

accordingly identified as such, for example, having the same serial number. Part of the game play is determining whether the two play objects are the same or different.

The uniqueness or degree of uniqueness of play objects in a collection, whether in a product line, in a master unit/play objects combination, in a toy package, and the like, depends on product design, marketing, toy packaging, game play pattern, etc.

The reader/interrogator circuit 207 is operatively connected to a microcontroller/microcomputer 213. The microcomputer 213 has a microprocessor. The microprocessor is connected to one or more ROMs (read-only memories) 214 that contain program code (or control program) for controlling the responses of the master/host/server or master unit 103 to the data received from the tag ICs 108a. The data from the tag IC "triggers" or causes the response of the host unit 103.

The program code or control program is generally a set of executable object code or machine instructions. It can be written in a variety of source code programming languages and then compiled and/or assembled into executable machine code or instructions appropriate for the target microcontroller. For example, the control program may be written in the C programming language and compiled into runtime object code. The control program could also be written in the native assembly language suitable for the microcontroller and assembled into run-time machine executable object code.

The control program operate all aspects of the input/output control circuitry of the master/host/server or master unit, including the control of the RFID transmitter and receiver master circuit and the control of its read

and write modulation of the RF carrier signal used to interface to the RFID tag chip transponders (play objects).

The microprocessor is also connected to RAM (random access memory) for temporary storage of operating data. Provision for connecting additional ROMS 215 to expand operating functions and modes is provided in the form of external cartridge connectors 217 which allow additional ROMs 215 to be piggybacked onto or daisy chained to the basic ROMs 214. The microcomputer 213 may have a plurality of miscellaneous I/O lines to arm/hand switches and other doll sensors.

The microcontroller includes various input and output lines, which can control other portions of the electronic circuit of the master unit, monitor pushbuttons or mechanical switch contacts, send and/or receive serial data streams, control available visual indicators, such as LEDs, and perform general input/output control for the entire master unit.

A voice/sound synthesizer circuit 219 is connected to the microcomputer 213 for converting digital data signals generated by the microcomputer in response to or caused by the data received from the interrogated tag ICs 108a to analog voice, music or other sound signals. The sound circuit 219 may include CELP, ADPCM, or the like.

As noted above, at least some, and possibly most or all, of the data signals generated may be data returned from the memory of the object 108. The analog sound signals are then applied to the input terminals of an audio amplifier 221 for driving a speaker 223 which reproduces the sounds for listening at an audible level.

The microcomputer 213 and its associated components, including the microprocessor, the voice/sound synthesizer circuit 219, and the amplifier 221 are powered by batteries contained in a power supply 225. For example, four AA or C alkaline batteries may be used. DC operating power can also be supplied from main AC line voltage by way of a suitable step-down transformer, rectifier and filter circuit as is commonly found in small, plug-in power supplies, so as to save on use of batteries when in a fixed location. DC operating power could also be supplied from twelve (12) VDC found in motor vehicles such as cars, trucks, busses, campers and even airplanes, by way of a suitable electrical connector and cable connected to a DC voltage regulator in the doll engine 103.

"Smart trading and game-playing cards" are another toy or game application of RFID technology according to the invention. Trading cards — e. g. baseball cards, football cards, and character cards, game-playing cards — e. g. action cards, duel and battle game cards, and role-playing cards, and other collectibles can each contain an embedded RFID tag IC for enabling novel uses for trading cards and collectibles in conjunction with dolls, and various other master/host/server toy or game units. The master/server/host unit can then detect each collectible as it is added to the collection and maintain information about the inventory of collectibles.

Each collectible can have, stored in its tag IC, data which associates the collectible with its owner. No other master unit toy or game unit can recognize, transfer, or exchange the collectible until its owner enables the stored data to be changed for associating it with a new

owner's master unit toy or game unit. That is, once a specific figure or other collectible is "caught" or "collected" once by someone, it cannot be caught or collected again by someone else, unless it is "traded" by the original owner to a new owner.

In still another embodiment of the invention, an RFID tag IC can be used to store the "collection" and "ownership" values in the memory of a tag IC embedded in an owner or collectors "master card," and to allow for trading or exchange of value with another owner/collector for creating "kid's money."

In many conventional trading card games, points are gained and lost during the play of the game. With these smart trading cards, points and values may be read and written during the course or play of the game. Furthermore, because these smart trading cards obtain its power from the master unit, a power source is not needed to be directly attached to these smart cards.

Smart trading cards may be implemented using inductive coupling with coils or using capacitive coupling with electrodes formed from printing conductive inks on the surface of the cards. Such conductive inks include black inks with "carbon black," i. e. conductive carbon particles are blended with conventional or water-based printing inks, and are printed with standard offset, lithographic or other printing processes.

Conductive inks may be aluminum, silver, gold, or other conductive materials printed on the back or inside surfaced of the cards.

With such smart trading cards and other play objects (described herein), the play substance values and information stored in the RFID tag ICs may be read and

updated (written) during the course of the game. Such play values/information may include virtual money, virtual weight of precious metal or a useful commodity, or virtual volume of valuable liquid for barter or negotiation in a game. It may also include virtual characteristic or attribute values quantitatively measured. Such play substance values/information may also be in nonquantitative form. For example, such values may include "Y" and "N" for "yes" and "no," respectively. Other values include non-numeric values such as "turtle," "cow," "house," "A," "B," symbolic symbols (for visual displays), and the like.

Considering that play objects in general, and not master units, contain values and information, a player can take a play object to another master unit that has never previously been specifically informed about earlier game transactions with that play object, and still have the game ensue based upon earlier play by that particular play object in earlier transaction with the earlier master unit. The game ensues particularly based on information/values stored in the play object by the earlier master unit. All, majority, or portion of the prior ownership and/or transaction value and history can be stored on the tag IC memory of the play object.

The master unit can be another toy or game apparatus, for example, in a public location such as a retail store or eating establishment like a restaurant. The play object with the RFID tag IC can be presented at the store to gain credits, obtain free prizes, bonuses, or discounts on purchases, or other benefits. Additional values or play substance values may also be added to a play object at the store or point-of-purchase location.

For example, if a smart trading card containing virtual money information is used in a casino game/play pattern, a child may use this smart card, i. e. the virtual play money, and bring it today to friend A to play with, and then take whatever virtual play money the child has ended up with after playing with friend A to friend B and C tomorrow. Thus the burden of keeping track of game play transactions (including ownership transfer, hit points changes, attributes changes, virtual money losses and increases, etc.) is not placed on any particular master/host/server.

An example of a microcontroller 213 that may be used in an embodiment of the invention is the RSC300/364 device from Sensory, Inc. of Santa Clara, CA. This component can be purchased from the company at prices as low as $1.50 per device. This low price qualifies the device as suitable for toy and game use.

The RSC300/364 is optimized for audio speech and sound output, as well as for speech input. The CPU portion of the device includes a suitable instruction set for controlling the RFID transponder devices, as well as to initiate output of speech, voice, sound or music signals from data tables stored in the fixed data memory.

Similar microcontrollers, such as the W536 "ViewTalk™" series of microcontroller chips from Winbond Semiconductor Company Ltd., Taiwan, would also be suitable. These chips generally support sound and speech audio output, and also include circuitry for operation of a typical LCD display screen containing alphanumeric characters and/or graphical, pictorial "icons".

Generally, the microcontroller 213 controls some external circuitry which embodies the RFID radio frequency control and data read/write transfers between the various RFID tagged objects and the main host control.

A Hitag reader chip, HTRC110, from Philips Semiconductor Corp. is an example of an RFID transponder reader/interrogator chip 207 used in a master unit 103. This device comprises a complete one hundred twenty five (125) kHz RFID transponder controller. It can be used with RFID transponder tag ICs operating in the one hundred twenty five (125) kHz frequency range.

In one embodiment, the HTRC110 is made to work with Philips HiTag RFID tag devices, sold commercially by Philips Semiconductor. These RFID tags are placed in play objects to be recognized by the toy or game.

While the HTRC110 device is named a "reader" by the manufacturer, it can also be used as a "writer" of data back into non-volatile read/write memory contained in certain kinds of RFID tag devices which support read/write memory operations.

Generally, very few external components are required to operate the HTRC110 IC in accordance with the invention. For example, only a few capacitors and a crystal for the precise control of timing within the IC are needed. Furthermore, only three digital I/O (input/output) lines are required to interface the entire RFID Reader IC to the microcontroller: Data In, Data Out, Serial Clock. This is well known and widely used in the industry, and is sometimes known as an I2C link.

The control program in the microcontroller transmits control and data information to the reader/interrogator

IC, and reads back control and data information from it via the above-mentioned three serial data lines.

Any and all control and data exchange functions of the RFID reader/interrogator chip may be implemented via the above-mentioned three lines: transmit RFID carrier On/Off, read data, write data, modulation control or the RFID carrier, demodulation control of received data, and error detection and correction.

As mentioned above, data/play values may also be updated or written back to the memory of the RFID tag ICs. These data may represent increased points in a game, ownership identification of a plastic toy figurine, or other toy and game-related information.

Another example of an RFID reader/interrogator is the standalone tag reader circuit (STARC), MC33690, from Motorola. RSC-300/364 chips from Sensory, Inc. in Sunnyvale, California may be used as voice/sound generator chips.

Philips HiTag RFID tag devices may be used in play objects. These RFID tags include the feature of reading and writing back data into a non-volatile memory on the tag IC device.

HiTag devices also support the so-called "anti-collision" feature that enables more than one RFID tag device to be recognized and controlled within the range of the play field antenna. They operate in the one hundred twenty five (125) kHz frequency band. This type of device generally uses amplitude modulation (AM) for the write-to-tag-memory process, and AM/PM for the read control.

The anti-collision feature functions in such a way that there is a random delay or a programmed delay in

which a specific RFID tag IC remains "off," i. e. does not respond with a transmission back to the RFID reader/interrogator. This way multiple RFID tag ICs (play objects) may be polled sequentially. This gives rise to the appearance of simultaneous responses because the time required for an interrogation/response is quite brief — tens or hundreds of milliseconds.

MCRF200, a contacless programmable passive RFID device, from Microchip Technology, Inc. may be used as an RFID tag IC. This chip, however, only allows for read-only data transmission. It also does not support anti-collision, thus it is suitable for "one at a time" play-object recognition game pattern.

If anti-collision features are desired, MCRF250 and MCRF355/360 from Microchip Technology, Inc. may be used in play objects. These chips may be used when multiple objects are to be detected at apparently the same time in a game environment.

MCRF200 and MCRF250 devices operate in the one hundred twenty-five kHz frequency band. They are read-only and are one-time programmable with a unique serial number. Hence, they can be used to represent many different tagged play objects. Up to ninety-six bits of serial number can be programmed, supporting trillions of unique identification codes.

Other RFID tags, using other types of signal modulation (e. g. AM, AM/PM, FSK, Direct PSK (change on data change), PSK (change at the beginning of a one)) and data encoding methods (NRZ Direct, Differential Bi-Phase, Manchester Bi-Phase, Bi-Phase IDI) suitable for required

error detection and correction capability may also be used.

Other frequency bands may also be used. RFID tag devices such as the iCode from Philips Semiconductor and the MCRF 355/360 and MCRF450 from Microchip Technology Inc are but two examples of devices operating in the 13.56 MHz radio frequency. Other RFID tag systems operate at SUHF frequencies in the five GHz range, such as devices manufactured by Hitachi.

If read and write features are desired, i. e. be able to write and update information in the play object, MCRF450 from the same company may be used.

While some RFID systems operate using primarily inductive coupling of the power and signal energy from the master unit reader/interrogator to the RFID tag IC, other RFID technologies use primarily capacitive coupling. For example, the BiStatix RFID devices from Motorola use capacitive coupling.

In embodiments of our invention, either inductive or capacitive coupling can be used – depending on the toy or game and the nature of the play objects being recognized. For example, a capacitive coupling element (antenna) can be formed by printing two surfaces with electrically conducting ink or other substance onto paper, plastic, cardboard, or other non-conducting material. These two surfaces form the two plates of a capacitor, which performs the signal and power energy coupling between the host and the RFID tag object. This method can be used to "print" smart trading cards, playing cards, collecting cards, or other flat, generally two-dimensional type objects.

Other chips or devices that support the functionalities and features described herein may be used in making the master/host/server and the play objects. Furthermore, there are many possible configurations of electronic circuits for RFID reader/interrogator devices and play objects. For the purposes of electronic toy and game playing systems, the cost of the electronic components generally must be very low, typically costing under five dollars.

User presentation, such as visual or audio outputs, may also be implemented by coupling such reader/interrogator circuits with appropriate display and/or audio circuits. Master/host/server or master units, for example, may include various visual display mechanisms, such as colored light indicators (typically LED devices), and alphanumeric display screens such as formed by LCDs (liquid crystal display), LEDs (light emitting diodes), and in dot matrix or custom graphic "icon" formats. Such displays convey text and numerical information including words, statements, or other visual information. User-presentation depends on the instructions contained in the program controlling the microprocessor.

In the case that the master/host/server or master unit has multiple antennas, switching circuits are used to enable or disable individual antenna elements. This is done under the control of the control program. The control program can also sequence the various antennas to determine if play objects are/are not placed in certain locations, and respond accordingly. This is generally dependent on the play-pattern or game environment enforced.

The exchange of power and data signals between the reader/interrogator and the play objects occurs rapidly, typically within one hundred through three hundred milliseconds for one hundred twenty kHz carrier frequencies of operation, and within under one hundred milliseconds for thirteen MHz carrier frequencies, if not faster. RFID tag systems operating at thirteen MHz or five GHz have much faster response and data exchange timings because of the higher carrier frequencies.

Thus, the response time of a master unit to play objects may appear to be almost instantaneous as far as human perceptual speeds are concerned. This also means that multiple antennas and coupling devices can be switched and multiplexed quickly such that the response of the master unit appears to be instantaneous by human perceptual speeds.

Referring to Fig. 3, antennas, particularly for the master unit, are preferably oriented orthogonally with each other and multiplexed or fed with complimentary RF signals. This enables detection of play objects in case the coupling antennas are at obtuse angles and enables the RFID reader/interrogator to read and interrogate a passive RFID tag with coil in any angular position within the sensing field.

With a single loop antenna, the RFID tag IC and its antenna must be closely coupled to the signal field so that sufficient RF energy is coupled to power and communicate with the RFID tag device. For toys and games, however, there may be situations in which a single loop antenna is not able to recognize a small RFID tag device, that is, if the RFID tag device is orthogonal to the

master unit loop antenna, energy coupling would be minimized and the tag IC would not be recognized.

Thus, a second loop antenna oriented at ninety degrees to another antenna is preferable. The multiplexing method of selectively enabling and disabling multiple antennas (discussed further below) may then be used so as to ensure maximum signal coupling to the RFID tag at any angle within the sensing field. A third or more antenna can be added to the setup in a similar manner, at other angles to the detection area or space, so as to maximize the RF coupling efficiency to the tag IC without regard to a specific orientation of the play object in three-dimensional space.

In one embodiment, a master unit reader antenna is a coil of wire or a conductive printed loop of thin copper. The antenna is preferably tuned to the reader/interrogator circuit by a series or parallel capacitors.

The size and dimensions of the antenna and its electrical Q factor determine how sensitive the reader/interrogator antenna is to weak RFID-tagged play objects and how efficient such antenna is in converting electrical power into the RF energy to implement or trigger the play object-detection. The design of antennas in the master unit, as well as in the play objects, thus are considered. In one embodiment of the invention, an antenna is formed by making a six-inch diameter loop consisting of twenty turns of #32 enamel insulated copper having a low-series resistance. This antenna is then placed over the head of a toy doll, for example, enclosed within a plastic sheath so that it appears to be a hair band or head band fashion accessory.

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Loop antennas could also be placed within and disguised in such things as necklaces, lockets, bracelets, belts, sashes, or other parts of a doll or the master unit itself. This loop antenna can also be placed inside the plastic head of a doll. Diameters of antenna loops may also be varied depending on where in the master unit, e. g. head versus hand, the antennas are going to be placed.

The term "antenna" includes specific RF energy and signal coupling devices and elements, such as small or large coils or loops of wires or RF conducting materials in the case of inductively-coupled signals, surface electrodes in the case of capacitively coupled signals, or other combinations thereof. The size and value of the antenna may be as large or small as practical or as required by the play pattern or game.

Even if multiple antennas are used, only one master reader/interrogator controller may be required (Fig. 4). For example, if four antennas are used 410, 412, 414, 416, they only need to be coupled to one reader/interrogator such as the HTRC110 HiTag reader 408 from Philips.

This exemplary circuit uses four antennas and eight MOSFET transistors to selectively enable and disable each antenna by way of four digital control signals D1, D2, D3, and D4 418, 420, 422, and 424. The group of eight transistors forms a DP4T (double pole, four throw) electronic switch with very low "ON" impedance and very high "OFF" impedance. The four digital drive lines 418, 420, 422, and 424 originate in the control of the microcontroller and are buffered by logic inverters to

switch the MOS transistors, which are biased by VDD at five VDC and Vss at ground level.

Furthermore, each of the four output pairs to each antenna may contain an additional fine tuning capacitor (C1 through C4) 426, 428, 430, 432 so as to provide the highest Q of the circuit for maximum energy transfer. In this exemplary circuit, one and only one antenna is enabled to be active at any given time. This circuit, however, may also be use to activate one or more antennas simultaneously with each other.

The TX1 434 and TX2 436 signals from the HTRC110 RFID reader IC 408 feed into and are received from the common two signal lines normally used for a single antenna.

Referring now to Fig. 5, HTRC110 RFID HiTag reader/interrogator IC is used as an exemplary IC1 560. An RSC-300/364 chip IC2 562 is used as a voice/sound generator and synthesizer.

The RFID reader IC 560 includes a four MHz quartz crystal or a ceramic resonator (XTAL 1) 574 for timing of the RFID chip 560. The main antenna L1 in the form of an inductive loop provides energy and signal communications with RFID tag devices (play objects) within its field of operation or detection area.

A tuning capacitor for output signal is also part of the chip 560 to adjust resonant frequency of output for optimum Q. Furthermore, couples receive energy signal back from RFID tag modulation into the RECEIVE signal processing circuits of the RFID reader chip 562.

The RSC-300/364 IC 562 is an eight-bit RISC microprocessor with digital input and output, audio signal

output from internal sound synthesizer, data memory, and program memory. This IC 562 is powered 564, for example, by four AA Alkaline batteries or other source of four to six VDC power.

An ON/OFF switch SW1 566 to turn the IC ON or OFF is also available. A speaker SPKR 568 is used to output audio information (e. g. voice, music, and sound effects). This chip 562 contains an audio output amplifier to drive the speaker 568, in this case, a two-inch diameter sixteen to thirty-two ohm impedance speaker.

An audio output filter capacitor COUT 570 is also included for better quality. A fourteen MHz crystal (XTAL 2) 572, which may also be used by the main clock of the CPU, is also available. Port zero lines PO1, PO2, PO3 578 are included for digital input/output control of the RFID reader by the CPU. A reset circuit 580 is also available to provide proper reset of CPU at power on.

Similar to the master/host/server 103 described above (Fig. 2), a master/host/server in another embodiment (Fig. 6) includes a visual display generator/controller 602 that controls a visual display. This way a toy may be responding not in audio form but in visual form.

The visual display 604 is generally used for user presentation and may include LEDs, OLEDs (organic light-emitting diode), LCDs, CRTs, incandescent lamps, 3D holographic or 3D stereographic displays, and other types of display technologies.

The visual display elements 604 may be single lights in various colors or white lite, alphanumeric LED or LCD displays, and fully dot matrix and raster type displays in monochrome or color screens, capable of showing numeric

and alphabetic characters in many different fonts and languages, and full pictures and motion video and animation type images. Using 3D displays also supports fully synthetic images, such as holograms or stereographic displays. Motion color videos and film images of photographs, action scenes or any other types of visual displays such as are seen on TV and movie screens may also be supported.

Visual display-driver integrated circuits 602 are commercially available from many companies, including Sun Plus, Microchip, Toshiba, National Semiconductor Corp, Texas Instruments, and many others.

For example, the SPLD801B LCD segments driver and companion SPLD802A LCD commons driver from Sun Plus may be used. Each of these IC can drive eighty segments or eighty columns for multiplexed LCD displays forming dot matrix images in arrays of eighty by eighty, or more pixels. These displays can form numbers, letters, icon graphic images, and other visual information. This type of LCD display driver typically interfaces to a controlling microcontroller unit via a few serial data, clock, and control lines.

Other LED displays can be driven with just bit output lines from the microcontroller driving an LED indicator light, or via a 2N2222 type transistor to boost the current. Incandescent lamps may also be driven this way.

In one embodiment, with just eight output pins from the microcontroller to drive LED anodes and another eight pins to drive LED cathodes via 2N2222 transistors to boost current, an eight by eight (8 x 8) matrix of LED lamps can be driven in scanned multiplex mode to display alphanumeric characters.

In another embodiment, Motorola MC144898 five channel LED/twenty five lamp driver can be used alone or in groups to drive a number of LED lamps in single or dot matrix, alphanumeric configurations. Using IC devices for CRT controllers or LCD display controllers, full large screen video or LCD displays in monochrome or color can be operated.

A number of IC devices manufactured and marketed by Epson Semiconductors can support CRT or LCD displays, or both, in embedded systems. Some examples are SPC8106 VGA LCD/CRT Controller, SED1330 LCD Controller, SED1353 LCD Controller, SED1354 LCD/CRT Controller, SED1355 LCD/CRT Controller, SED1356 LCD/CRT/TV Controller, SED1374 Embedded Memory LCD Controller, and SED1375 Embedded Memory LCD Controller.

In another embodiment, a microcontroller can control both a visual display generator/controller and a voice and sound generator. This way a toy may be designed to have both visual and audio user presentation.

Referring now to Figs. 7A and 7B, in still another embodiment of the invention, RFID tag ICs 708a and suitable antenna 708b can be embedded inside of play objects 708 in the form of small play blocks molded from plastic, carved from wood, or other non-conducting, non-RF shielding materials. The master unit and control engine 703 is contained inside of a large tablet-shaped form 701. The engine 703 includes the sensing antenna coil 705 in the surface 709, a reader/interrogator circuit 707, a microcontroller 713 with voice/sound generator IC, an

audio amplifier and speaker 721/723, and batteries 725, similar to the arrangement shown in Fig. 2.

The "magic tablet" 701 can recognize the play blocks 708 placed on it. The play blocks 708 may have printed or molded legends 708d on one side of the cube, such as letters of the alphabet, numbers, arithmetic signs such as +, -, / and X, or pictures or icons of animals such as cows, horses, chickens, or pigs, or other objects such as musical instruments, musical notes, or other things.

The magic tablet 701 has a similar "engine" 103 as the dolls described above. The control program could operate in many different modes.

In speaking only, the tablet voice just says the name of a letter or number block placed on it. If a number of blocks are placed on the tablet, using anti-collision techniques, the master unit 703 accordingly identifies and processes all the blocks placed.

The magic play blocks 708 and tablet 701 may have complementary Velcro, or possibly magnetic, surfaces 710a, 710b for establishing a preferred orientation of each block and its antenna 708b to the tablet and its antenna 705 so as to maximize the RF energy transferred between the master unit and the RFID tag IC 708a and antenna 708b contained inside the block or object 708 placed on the magic tablet.

Alternatively, referring to Fig. 7C, the play block or object 758 could contain the RFID tag IC 758a and small loop antenna coil 758b in a diagonal orientation inside the play block or object, so that regardless of the play block or object orientation to the tablet surface 709, the loop coil antenna 758b inside the play block or object will couple sufficient RF energy to the associated RFID

tag IC 758a in that play block for proper operation with minimal transmitted power.

The tablet 701 can also ask a child to spell a word such as "DOG" and then detect when the correct letter play blocks 708 have been placed on the tablet, and speak accordingly, correct or not, to help teach a child how to spell. In this embodiment, the locations or positions of where the blocks are placed are not considered.

In one embodiment, the word "DOG" is spelled correctly when a child places the correct letter one after another, i. e. "D" then "O," and then "G." How the blocks are placed on the tablet does not affect how the RFID reader/interrogator reads the data contained in the RFID tag IC, so long as the play letter object is in the detection area of the RFID reader/interrogator.

In another embodiment, a child may place all three play blocks ("D," "O," and "G") at the same time to correctly spell the word "DOG." Still in another embodiment, the order of when the letter blocks are placed is irrelevant so long as the correct letter blocks are placed.

Detection of multiple play blocks or objects 708 is again accomplished by the control program of the microcontroller 113 and the reader/interrogator circuit 707. Data that are exchanged, that is transmitted by the RFID tag and read by the reader/interrogator, are actual digital bits of data and not just resonance frequencies.

The circuit of the reader/interrogator 707 operates at the selected RF frequency of the RFID tag IC 708a and antenna 708b. Commonly used frequency ranges are 100-150 kHz, or 13.5 MHz nominally, or other frequencies.

The specific methods of data modulation used in a specific RFID tag system are not of consequence to the inventions of toys and games. The basic operation of the invention can be adapted to various modulation methods and frequency ranges, depending on the cost of the circuits and the range of operation.

It is very important to note that the detailed control of the reader/interrogator circuit and the data transmission and reception is highly dependent on the control of the reader/interrogator circuit which is effected by portions of the operating system and drivers contained in the main "engine."

The disclosed master/host/server toys or game units can deal with detecting multiple play objects i.e., where more than one play object are presented to or removed from the toy or game master.

For example, a doll 110 can ask to "see" three shapes in flash cards or play objects 108 containing suitable RFID tag ICs 108a. Then the doll can ask for one of the shapes or objects 108 to be removed. If the incorrect one is removed, the doll will recognize that, and speak a suitable warning response.

Because a considerable amount of power is consumed with the activation of the reader/interrogator circuit 107 to transmit RF energy to detect the possible presence of an RFID tag IC 108a within the range of the master/host/server toy or game unit, such operation must be managed carefully. The master control program can manage the activation of the reader/interrogator circuit 107 on a time-multiplexed basis, so as to conserve power in operation and therefore prolong the battery life of the toy or game.

For example, the discussed apparatus provide for the time-multiplexed activation of the reader/interrogator circuit 107 on a time interval basis to conserve battery power. Rather than leave the reader/interrogator circuit 107 activated on a continuous basis, the master/host/server or master unit 103 only activates this circuit 107 very briefly a few times per second, until a suitable RFID tag IC 108a is found to respond. In this manner, the method of control reduces the power consumption by a significant amount, and extends the battery life of the toy or game unit.

Referring now to Figs. 8A and 8B, there is shown a smart trading card master device 803 in the form of a hand-held reader for smart trading cards or flash cards 808. A trading card 808 can be slid into a mechanical slot 812 provided for the purpose of holding the card 808 in place, the card can be placed on the surface of a hand-held reader, the card can be waved in front of a table (e. g. Figs. 7 or 13), or via other means for read/write detection and operation by the master unit.

The reader 803 has a reader/interrogator circuit 807 and antenna 805 for communicating with the RFID tag ICs 808a embedded within the trading or flash cards 808. The trading card control master (master unit) 803 can read and write back selected data information to and from the RFID tag IC 808a embedded in the trading card 808. This is performed under the control of a single chip microcontroller 813 which includes a speech/sound synthesizer circuit 819 with digital to analog converter suitable to drive audible sounds from a miniature loud speaker 823 inside the unit.

Moreover, the microcontroller 813 can include the circuitry to drive segments and layers of a common, multiplexed LCD alphanumeric display screen 814 on the master unit, whereby information can be visually displayed. Power to the master device 803 may be provided by batteries 825.

In addition, the microcontroller can include circuitry to communicate with an external device such as a personal computer, a hand-held computer, or other device, via a wired serial communications interface for RS-232, USB, IEEE 1394 or other standard or custom communications network.

With such a network communications link, information about the trading cards, their values, ownership, or other information can be communicated to other programs and services, and could also be conveyed via the Internet to various websites offering prizes, recognition, or other services to the card collector or game or toy player.

In a text-to-speech application of the invention, words and phrases can be encoded in the tag IC memory in the form of ASCII or other generally known and used character encoding techniques by using RFID tag ICS with a sufficient number of data bits or read only or read/write memory.

For example, the word "HOUSE" can be encoded in 6-bit ASCII code, that is six data bits per alphanumeric character, using a total of only thirty data bits. The RFID tag IC containing this data bit pattern could be embedded inside a flash card, a trading card, or any other small two or three-dimensional object.

Upon detection and query of the flash card, trading card, or other object by the doll, a reader or other

master unit toy or game unit, programmed to recognize the encoding of words, the five letters of the example word "HOUSE" would be received and then conveyed to a software program and/or combination of software program and voice, sound or speech synthesizer, in any of many various languages, to be converted into the spoken word "HOUSE" by the toy or game unit.

A very important feature of this embodiment of the invention is the ability to form hundreds, thousands, or even millions of unique identity flash cards, trading cards, or other play and collectible objects containing RFID tag ICs, which then cause the master unit toy or game unit to speak, or to display and speak, the word or words programmed within them. This is significantly different from using a master unit toy or game unit that has a sound and speech voice synthesizer using only pre-recorded words or phrases of language, which would be activated by control and behavior programs in the toy or game unit.

In the foregoing embodiment of the invention, there can be a virtually unlimited range or spoken words and phrases, activated by one or more suitably programmed RFID tag ICs contained in flash cards, trading cards, or other objects. As noted above, if desired, the major portion, if not all, of the spoken or displayed data may come from the object's memory. The main advantage of this implementation is that the toy or game unit does not have to be completely pre-programmed with all the words it might ever have to speak or say or display. Rather, the toy or game unit need only have a text-to-speech converter program in its control program, with proficiency in one or more spoken languages. Such a toy or game unit could be of use in learning and teaching various languages.

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The number of data bits in the RFID tag IC, perhaps as many as one thousand bits, could contain as many as 150 alphanumeric characters, (i.e. letters, numbers, punctuations, and other control codes) sufficient so that one flash card, trading card, or RFID tag IC equipped object, could cause the doll, master unit toy or game unit to speak a specific sentence or sentences of multiple words and phrases.

In another preferred embodiment of the invention (Fig. 9A), a hand-held game device 920 receives an RFID reader cartridge 904 and a game cartridge 902. The hand-held device 920 typically includes a microcontroller, a visual display 924, e. g. an LCD or LED, sound-generation circuits, an audio output speaker 926, and control buttons 922.

The RFID reader cartridge 904 is preferably a plug-in accessory that fits into hand-held video game devices such as NINTENDO® GAME BOY, NINTENDO® GAME BOY ADVANCE, and other types of programmable hand-held game and computing units. This plug-in accessory may also be designed to fit into hand-held computing devices like PALM computers, PDAs, and even with console video games units like SONY PS-2, NINTENDO GAMECUBE, MICROSOFT XBOX, etc.

The RFID reader cartridge 904 includes RFID reader/interrogator circuit(s) 908, antenna(s) 906, and control/interface circuit(s) 910 to the hand-held device 920, particularly to the main bus. The antenna sensing elements 906 preferably protrude out or are placed on the rear side of the RFID cartridge 904, and preferably formed as loops.

The RFID cartridge 904 is generally plugged into an interface or slot 928 available in the hand-held device 920. This interface 928 is generally where game cartridges are plugged in or inserted. For NINTENDO® GAME BOY ADVANCE, for example, the game cartridge or game pack is plugged or inserted at the back of the unit. This interface or slot 928 includes multiple electrical connections to supply operating power to the game cartridge 902 and the RFID reader cartridge 904 and for connecting address, data, and control signal lines or generally to the main bus.

The RFID reader circuit 908, with the antenna 906, reads and writes information back to play objects 990. This play object 990 has at least one RFID tag circuit 994 and an associated antenna 992. The play objects may be in many forms, including action figures, cards, and the like.

The RFID reader cartridge 904 is preferably an intermediate cartridge which plugs into the hand-held device 920 via the interface/connector/slot 928 (Fig. 9B) The RFID cartridge 904 also includes a receiving interface/connector/slot 912 into which a game cartridge 902 may be plugged-in.

This connector/interface 912 is generally a pass-through interface so that the game cartridge 902 is able to convey all program code and data to the hand-held device 920. The control circuits 910 is generally used to interface input/output controls to the hand-held device 920.

The game cartridge 902 contains the play-patterns or "the game" that is going to be played by a user. It typically includes a memory chip, such as a read-only-memory (ROM). The ROM contains the operating program and

data patterns for graphics, sounds, animations, and game play.

The RFID cartridge 904 also includes interface circuit(s) 910 to the main bus of the hand-held device 920. Instructions on how to process the information read by the RFID reader circuit 908 are also contained in the game cartridge 902. Such RFID instructions control how information read by the RFID reader 908 is processed within the game.

In this embodiment, a multitude of games or play-patterns may thus be designed to work with various play objects. Playing video games on hand-held devices is thus enhanced with the introduction of RFID reader cartridges and RFID play objects.

These RFID play objects may contain serial numbers, identity numbers, or other types of information such as those related to the object or to the game in general. This information may thus affect how a game is played.

For example, as a user holds an RFID action figure play object 990 and passes it over or near an antenna 906 (i. e. the figure is in a detection area), the RFID reader 908 reads the contents of the RFID tag ICs 994. This information may then enable this character in the game (i. e. bring this character into the game), alter attribute values, such as strength and hit points, instruct the hand-held device 920 to say "Hey, it's Superman!," alter the logic of the play-pattern of the game, give clues to the users, extend playing time, and the like.

The RFID reader cartridge 904 may obtain its power from the hand-held device 920. It is also possible that

the RFID cartridge 904 has its own source of power, such a battery that is part of the RFID cartridge 904.

In another embodiment of the invention, the hand-held game or computing device has an integrated or built-in RFID reader/interrogator under the control of a microcontroller or a processor. Thus, the RFID cartridge 904 is thus unnecessary. A game cartridge with the desired play pattern or game needs to only be inserted into these hand-held game devices. The program contained in this game cartridge dictates how the processor controls the RFID reader/interrogator circuit. The antenna associated with the RFID reader/interrogator may be placed in various location of this device, such as front or back of the unit.

In another embodiment of the invention, instead of a hand-held game device, a video game console unit 930, such as an Xbox unit of Microsoft Corporation or a PlayStation® unit of Sony, is connected to a television console 932. The video game unit 930 is connected to the tv via a wire interface 934.

The video game unit 930 has a built-in or integrated RFID reader/interrogator 940 and an associated antenna 948. It also includes a processor 942. The game or play pattern that is going to be played is contained typically in a readable medium 936, such as a CD-ROM. It contains the program of the game.

The software or program 936 is loaded into a program-receiving unit 938, such as a CD reader. In conjunction with the processor 940, the instructions contained in the program are executed by the processor or by appropriate components typically under the control of the processor.

The RFID reader/interrogator circuit may also be under the control of the processor.

The program or software 936 may also be received by the video game unit 930 via a connection, such as the Internet.

RFID tagged play objects may be waved or placed near the game 930 and accordingly recognized and processed under the rules of the game. User presentation such as visual display and audio output are presented by the connected television or display unit 932.

Alternatively, the RFID reader/interrogator 940 and associated antenna 948 is not integrated with the game device 930. In this scenario, an RFID reader cartridge is plugged into an available port in the game device 930. The program 936 loaded into this game device and the processor controls the RFID reader/interrogator including how data read should be handled.

In another embodiment, a hand-held game or computing device 950, such as an iPaq unit from HP or a PDA, includes a visual display 954. It also includes an RFID reader/interrogator 960, an antenna 952, a processor 962, a speech/sound synthesizer 964, and a speaker 966. The game program may be preloaded into this hand-held unit or be downloaded into this unit via other means, such as a connection to the Internet or a connection to a software/program media reader. User presentations are all handled by this same unit 950.

Alternatively, the RFID reader/interrogator is not integrated to the system but is available as a plug-in accessory. As devices become popular, they, however, become integrated into the system, like Ethernet cards are

now becoming standard devices built-in into computer laptops and notebooks.

Thus, in general, in this type of game/computing devices, the RFID reader/interrogator may be built-in or integrated in the game/computing device, or may be available as an accessory to be plugged in or connected to the main game/computing device. User presentation may be presented by the game/computing device itself and/or by external devices connected to such game/computing device.

Referring to Fig. 10A, in one embodiment, these play objects containing RFID tag ICs are manufactured containing initial ownership status information 1004. This initial status information may be in several forms, e. g. a bit "0" indicating that this object has never been owned, a series of blanks or nulls indicating no ownership, or a textual field with "never been owned" written on it.

Initial value information, for example, play currency, hit points, strength level, character level, name, etc. may also be stored as part of the play object 1004. This value or set of values, including status information, may be numeric and/or nonnumeric.

Once a play object is purchased for the first time, the store using a master/host/server (transactor 1033 Fig. 10B), i. e. capable of handling transactions, including writing to play objects, updates the play object with new ownership information. This master unit or transactor 1033 is coupled to an input device 1044 enabling the purchaser of that play object to enter ownership information, such as name, address, and phone number. This input device 1044 may be a keyboard, a touch screen,

a computer, a voice-activated input device, or any input-enabling device. Other master units able to handle this type of transaction may also be used.

Once the purchaser provides his or her ownership information, the master unit transmits and writes this information into the RFID tag ICs of the purchased play object 1006 (Fig. 10A). Security information 1008, such as password, is generally also entered by the user so that future ownership information may only be written into that play object if a proper password is provided. This password is also stored in the play object.

Other values of the play object may also be updated according to the play-patterns programmed in the master unit 1010.

In the future, if the owner decides to trade or sell this particular play object to another person, the owner may do so by using a master unit. The owner may use any master unit that is capable of handling this type of play-pattern transaction.

To enable the transfer transaction, the current owner enters the same password previously stored in the toy. This security information is verified by the master unit 1012. This is done assuming that the play object is within the area of detection, i. e. the RFID reader/interrogator communicates with the RFID tag ICs of the play object.

In more detail, the RFID reader/interrogator of the master unit reads the RFID tag ICs of the play object – particularly the password. The password entered is then verified against the information read. This is done by the microcontroller, under the control of a program.

If the password entered matches the one stored, the master unit enables the new owner to provide new ownership information and security information via an input device. This new ownership information and security information are stored in the RFID tag IC of the traded play object, for example, card 1014, 1016.

Password security thus ensures that only valid transactions are written into the play objects. Theft and illegal possession of play objects are thus alleviated.

This process may be repeated if the play object is later on transferred to another owner. Ownership information history may also be stored thus enabling users to see its history. Other types of information may also be stored in play objects, including numeric values (e. g. monetary values), alphabetic values, and nonalphabetic values. With the transfer, values of the play object may also be updated according to the rules or logic of handling such transactions 1018.

Non-face-to-face exchanges and trades may also be done. The current owner may send the play object and the valid password to the new owner. The new owner may then use an available and appropriate master unit to store new ownership information. The new owner does this by supplying the valid password and new ownership information.

In one embodiment, each play object is associated with a card, like an ATM (automated teller machine) card. This card contains information about the play object or collection of play objects owned, for example, by an individual. To exchange play objects, each owner only has to wave the card or place the card near the master unit or

master/host/server to effect the transfer and enter the appropriate security or PIN information. This way, owners can have their collection information in one master card.

Alternatively, each play object may have its own associated card containing ownership information about that play object, similar to having a birth certificate or a car registration form

A master unit may handle the transfer of more than one type or product line of play objects. Meaning that a master unit may handle various play objects so long as the master unit 1033 (Fig. 10B) is able to read/write information from the RFID tag ICs of the play objects. This means that play objects may be sold without corresponding master units 1033. So long as a user has access to an appropriate master unit, exchanges and transfers may be done.

In another embodiment, all master units, regardless of the play-patterns or game processed, can handle exchange and transfer transactions of all or a number of play objets. This may be done, for example, by having certain information be stored in these play objects. In another embodiment, only certain master units handle this type of transaction, e. g. exchanges and transfers.

A master unit 1033, handling transfers and exchanges, generally has an antenna 1032, a display 1042, an RFID reader/interrogator 1034, a speaker 1040, and an input device (keyboard) 1044, (microphone) 1052 .

In doing exchanges, for example, the play object or the container of the play object 1002, 1004 contains the RFID tag IC. To initiate an exchange, the owner of each respective action figure enters their user name and

password 1050, 1052. The master unit 1033 processes this information. If the information entered is correct, the RFID tag IC of each respective play object or container of each respective play object is updated accordingly to reflect new ownership information.

Values, such as money value, play currency value, strength, hit points, and the like are associated with each action figures. This information and values depends on game or play-pattern designs and thus may also be accordingly updated during the exchange function. Information and values may also be updated and revised by connection via a master unit to a network, the internet, store point-of-purchase registers, and the like.

In another method of trading, exchange, or processing of play object or variable play substance information (e. g. exchange of play money), each play object 1002, 1004 is associated with a master control card 1050, 1060. Each play object 1002, 1004 also contains a unique serial number or any other identity-type information in its RFID tag IC. The master control card also contains an RFID tag IC and an antenna. The RFID tag IC also contains the serial number of the associated play object. Preferably, the master control card also contains a personal identification number (PIN) so that unauthorized transfers or trade are prevented.

To initiate the process or transfer, the owner of the action figure, for example, action figure 1 (1002), waves or places his or her master control card 1050 over the transactor master unit 1033. The owner then is prompted, via a user presentation display, to enter his or her PIN. The owner enters the PIN via an input device, such as a

keyboard 1044 or microphone (voice commands) 1052. Once the user enters the proper PIN and is verified by the master unit 1033 by reading the RFID tag IC of the master control card, the new owner is then prompted to enter a new PIN. The master control card 1050 associated with action figure 1 (1002) is then asked to be waved over the master unit 1033 so that the PIN of the new owner may be written into the memory of the tag IC. Optionally, action figure 1 (1002) may also be asked to be waved over the master unit 1033 so that information, e. g. transfer history, new PIN, variable play substance information change, and the like, may be written into the tag IC of the traded or exchanged action figure 1.

It is also possible that variations on this operation may be made, for example, no PIN is required, owner personal information is written into the processed play object, ownership is not changed but only variable play substance information (e. g. transfer of virtual play money), additional master control cards are needed, etc.

In still another embodiment of the invention, a game or toy 1100 (Fig. 11) includes a master unit in the form of a toy car or toy moving vehicle and several play objects in the form of cards 1104, 1106, 1108 and three-dimensional objects 1110, 1112, 1114, with each play object containing one or more RFID tag ICs 1132 within them and a suitable antenna element 1134. The antenna of the master unit is preferably at the bottom of the plastic car 1102 and/or in the side of the car.

The game or play pattern is designed such that the vehicle 1102 makes an audio response as it recognizes each play object. This response, for example, includes "That's

the letter 'A'" 1104, "This is a turtle 1106," "That's a triangle," "What a pretty oak tree" 1110, music, sound effects, and the like.

In one embodiment, a child pushes or remotely controls the car 1102 to travel 1122 on a predefined track 1116. The moving vehicle may also be self-powered. As it travels through the track 1116 and over each card, it recognizes the play objects, 1104, 1106, 1108, and accordingly generates and projects the proper audio presentation through the car's speakers.

In another embodiment, a child freely pushes the car 1102 in an arbitrary path 1124, i. e. without a predefined track. As the car passes or comes near the play objects 1110, 1112, 1114, the car generates the appropriate audio response, such as "What a pretty oak tree" 1110, "Oh, that's the bakery" 1112, "A rabbit!" 1114.

The car can also make other types of sound effects, besides speech, as well as activate other effects in the moving vehicle such as flashing lights, changing speed, turning motor on and off, and causing moving pieces to move.

As can be seen from the various embodiments of the invention, it is feasible that master units and play objects from one game may be used in another game, so long as data transmitted can be recognized and understood by the master unit being used. This means that numerous master unit and play object combinations may be created with minimal changes to the underlying master unit circuit and/or program.

In yet another embodiment of the invention, a game 1200 (Fig. 12) includes a hand-held unit 1203, such as a

wand, scanner, or waver master/host/server or master unit, with an RFID reader/interrogator circuit and antenna, or portions thereof, within it. The hand-held unit may be in various three-dimensional forms. The antenna 1213 is around the open viewport of the hand-held unit 1203. The master unit toy 1203 also includes a microcontroller, an RFID reader/interrogator, and a voice/sound generator. The play objects each contain an RFID tag IC and at least one antenna.

As the child waves the hand-held unit 1203 over the play objects 1202-1214 with the RFID hand-held master unit ICs, appropriate responses are generated. Such response may include, "That's the letter W" 1202, "That's a black rabbit" 1204, "That's a star" 1206, "That's a green turtle" 1208, and "That's an airplane" 1210. These responses may be varied. The user presentation may also be varied, such as there could be additional visual presentation or visual effects displayed by the hand-held scanner unit, the hand-held unit can vibrate as each play object is recognized, pieces of the hand-held unit may move (e. g. dance), and the like.

Another play pattern can be that moving the RFID-tagged play object close to the hand-held unit or scanner 1203 will activate a price charge in a toy cash register or store play set, like a retail supermarket check-out, etc.

The hand-held unit may also take another form. Instead of a wand, the master unit toy may be in the form of a glove, a hand-held puck or pod, a long stick, a rod, a pencil, and the like.

The antenna/energy and data-coupling element is located in the tip or end of the wand/rod — hand-held

element. This "sweet spot" can be waved and scanned over the tags.

Physical touching of the wand sensing element to the toy or game itself is also possible, for play pattern and play action value. The physical contact, however, is not required for signal and energy coupling, but is yet another means of play pattern in addition to waving, scanning, and other signal exchange methods.

In another embodiment, the master unit 1223 (Fig. 12B) is not entirely housed in one object or toy. In this embodiment, the antenna 1233 and the RFID reader/interrogator are in the hand-held unit itself. Other components of the master unit, however, such as the microcontroller 1241 and the voice/sound synthesizer 1239 are in another unit such as a box 1237. Power source may also be stored in this box 1237. The wand 1223 and the box 1237 are connected by a wired connection 1225. Thus, it is possible that the master unit engine be partitioned and housed in several entities and locations.

Due to RF circuit design, it is preferable that the RFID reader/interrogator circuit and the antenna or coupling element be in close physical proximity with each other so as to minimize detuning effects.

In an alternative embodiment, a play object 1250 (Fig. 12C), in this example a toy doll, contains a number of RFID tag ICs and antennas 1252. Each RFID tag IC is associated with an antenna to identify a particular location or body part of the doll.

For example, if the hand-held unit 1203 is placed near or over certain areas, appropriate user presentation is generated. Examples of such response include "This is my nose" 1252, "This is my right arm" 1254, "This is my

right hand to hold a bottle" 1256, "This is my right foot" 1258, and "This is my left foot" 1260. Instructions such as "Touch my nose," "Tickle my left foot," "Touch my arm," and the like may also be included as part of the game. This play object may be used to teach children various body parts.

This play object may also be a game board with a number of RFID tag ICs, or any two- or three-dimensional play object with a number of RFID tag ICs in various locations of the object. When the movable hand-held unit is waved on this RFID-tagged locations, game instructions may be given in accordance with the game or play pattern played at that time. This hand-held unit thus may be fashioned as to look like a game controller or a playing piece.

In yet another embodiment of the invention, the master unit toy 1300 is a loop-like device. The game is designed such that various play objects are flown through the loop 1302. This loop also contains the antenna associated with the RFID reader/interrogator 1304. A voice/sound synthesizer 1306, a speaker 1310, a micro-controller 1308 are also housed in this toy unit.

To play this game, a child flies the RFID-tagged action figures 1132-1356 through the loop. The master unit toy 1302 accordingly generates the proper user presentation, such as audio responses. For example, the master unit says "Hey, It's Superman," "Show me Batman," or "It a Firefighter," when the play objects 1354, 1356, 1352 are respectively flown into the loop.

When the master unit detects more than one action figure 1352, 1354, 1356, for example, near the loop, a

battle play pattern may be initiated. For example, a play by play story, for example, "Superman took some three points damage," "Batman's strength went up by two," and the like may be presented to the users. The RFID tag ICs of respective action figures are also accordingly updated to reflect new or updated information due to the play that has ensued.

In another embodiment, the master unit toy 1333 is in table or box-like form. This toy 1333 includes an antenna 1332, an RFID reader/interrogator 1334, a microcontroller 1336, a speech/sound synthesizer 1338, and a speaker 1340. As the play objects are flown or passed over the table 1333 the appropriate user presentation and update to the appropriate RFID tags are presented.

User presentation as applied to the many embodiments of this invention is not limited to audio presentation. Other forms, such as visual, tactile, and olfactory presentation may be incorporated in the master units. Appropriate components to handle such user presentation have to be incorporated in the master units.

The various embodiments of the invention discussed herein generally works in a game environment that includes a master/host/server or master unit and at least one play object with an RF tag IC. The game environment generally works in such a way that communication, particularly, data exchange, is generally established when the play object is in at least one detection area of the master unit for the minimum time required to complete a successful RFID transponder data exchange, read, or read/write operation. This means that communication is established even if the master

unit is stationary and the play object is stationary, even if the master unit is stationary and the play object is in motion (e. g. waving or passing of an RFID-tagged flash card or play object in front of or around the dolls shown in Fig. 1), even if the master unit is in motion and the play object is stationary, and even if the master unit and the play object are both in motion.

To explain the above-mentioned features of the invention, another embodiment of the invention is herein discussed and shown in Fig. 14A. In this game environment, a master unit vehicle 1402, such as a tractor, may be moved by a child.

This vehicle 1402 contains an RFID reader/interrogator circuit and an antenna. This antenna is preferably placed at the bottom and/or side of the tractor. The RFID reader/interrogator is hidden inside the vehicle. A microcontroller containing a program and a speech synthesizer are also housed in this vehicle.

The tractor 1402 interacts with play objects 1404-1410. These play objects, for example, may represent things that a person sees in a farm. These objects may be placed by a parent around a young child so that the young child can play with the tractor and these play objects.

These play objects 1404, 1406, 1408, 1410 include RFID tag ICs and associated antennas. The RFID tag ICs contain information identifying the object. This set of information may include serial number, information to be digitally synthesized, and object name (e. g. "cow," "pig," or "sheep").

In one play pattern, when a child moves the tractor master unit 1402 close to a play object, for example, the cow 1404 so that a communication 1414 is established

between the RFID reader/interrogator of the tractor and the RFID tag IC of the cow, the tractor responds, for example, by saying "Your tractor is in front of a cow. 'Moo moo'" 1412. In this scenario, the cow is stationary/still while the tractor is in motion (Fig. 14B).

Questions and instructions may also be part of the play pattern. Instructions may be given such as "Drive the car to the pig." The master unit may then determine if such instruction was properly carried out.

When a communication 1414 is established, the RFID tag of the cow 1404 transmits and receives information in the form of data bit streams to and from the tractor 1402. The RFID tag receives their operating power from the RF energy transmitted by the master unit at the same time as data exchange occurs.

This information is then processed by the micro-controller under the control of a program. Appropriate responses, as coded in the program, are accordingly generated. For example, the speech synthesizer may instruct the microcontroller, in conjunction with a speech/sound synthesizer, to generate or synthesize a statement 1412.

Alternatively, the child may also move the play object, e. g. cow 1404, near the tractor 1402 so that a communication 1414 between the cow and tractor is established (Fig. 14C). The tractor at this point is in a fixed or stationary position. The appropriate response 1412 is generated similar to the scenario above.

The child may also hold the tractor 1402 and the cow 1404 in each hand and slowly move them close together (Fig. 14D). Even though the tractor and the cow are in

motion, so long as a communication is established – i. e. the cow is in a detection position relative to the tractor, the appropriate response 1412 is generated by the tractor.

Furthermore, even if the tractor and cow are stationary (Fig. 14E), so long as they are placed in such a way that they communicate with each other, the tractor would recognize the cow and generate the appropriate response. The number of times a response 1412 is repeated depends on the instructions contained in the program controlling the microcontroller.

When a master unit toy, in this embodiment — the tractor 1402, is in a position to communicate with the object, the tractor 1402 is able to continuously recognize the object, e. g. the cow 1404. How often and how continuous this recognition occurs may depend on power-saving mechanisms contained in the master unit toy.

In another embodiment of the invention, a master unit vehicle interacts with a mat or a board displaying various artwork or pictures painted or drawn by various artists. Each artwork is associated with an RFID tag IC and at least one antenna.

A child may move the vehicle over the mat and when the vehicle is over or passes over an artwork (i. e. a communication is established), the vehicle recognizes the artwork and responds accordingly with voices/sounds or any other responses instructed by the program controlling the microcontroller of the master unit. It may for example identify the artwork, for example, "Van Gogh, Starry Night."

The cards may also contain shapes, numbers, and the like. The play-pattern may also involve just counting the cards recognized, for example, saying "We have seen three stars and two squares."

In still other embodiments of the invention (Fig. 15), a master/host/server or master unit is embodied in several devices such as in a cellular phone 1502, a videophone 1504, or a computer 1506. These devices have a similar "engine" 103 as the dolls previously described (Figs. 1A and 1B). These various devices may be located in several places, such as the place where the play objects are purchased, the user's home, toy stores, etc. These devices also have a similar RFID reader/interrogator engine as the dolls, toys, and games previously described (e. g. Figs. 1 through 5).

In one game play-pattern, play objects such as POKÉMON® cards with RFID tag circuits are read by such game units 1502, 1504, and 1506. The RFID tag ICs include read and/or write memory devices and may contain identity numbers, such as serial numbers, as well other-information about that card. It is similar to the play objects 108 in Fig. 2

When these cards are read by the RFID reader/interrogator contained in these game units 1502, 1504, 1506, information about the cards are presented to the users, preferably in both visual and audio form. The information provided to the users may be those directly contained in the tag ICs of the cards themselves or may be provided as part of the program contained in the microcontroller.

The program may also contain other instructions such as role-playing game instructions enabling the characters

represented by the cards to compete in duels and in car races, embark in adventure fantasies, and other play-pattern activities and functions.

Play objects in this scenario thus may be purchased from various vendors and locations. A user may use any master unit that is programmed to recognize and present information about the play objects. The user is thus not compelled to purchase a master unit, but may borrow available master units, if so desired.

Children, and even adults, love to collect things such as cards, action figures, cars, and accessories. These collectibles may be made in the form of play objects containing RFID tag ICs, including at least one antenna. This way, when children are showing off their price collection, even if more than one child owns the same collectible item, e. g. the same POKÉMON® card, the ownership of each card is easily identifiable.

Other uses and benefits of keeping information as part of the play object are apparent and are handled by several embodiments of this invention.

A board game 1600 (Fig. 16) is yet another embodiment of the invention. This board game may have one to four players, or more, depending on the game rules programmed and selected for play. Each player has his or her own set of coins or tokens — each containing a read only or read/write RFID tag IC (play objects). The objective is to remove other coins off the game board or table. The board game is usually placed on a table.

Each player puts his or her coins on the table and flips a coin in turn. If a player succeeds in removing

other players' coins, those coins are now his or her to keep.

The board game 1600 generally contains a microcontroller 1619, a speech/sound synthesizer 1620, a speaker 1622, an RFID reader/interrogator 1616, and an antenna 1624. A control program controlling the microcontroller is also available. There could be one RFID reader/interrogator 1616 in each control box 1616, i. e. in each corner of the board. An antenna is associated with each RFID reader/interrogator 1604.

Variations on the number and placement of RFID readers 1604 may be implemented based on the play-pattern desired. For example, there could be more than four RFID readers on the board, a number of antennas are placed in the middle of the playfield 1610, and the like. There could also be four separate antennas, one located in each corner of the board. Each area may have a separate antenna, which can be multiplexed by a single interrogator. This way, the game can be played knowing which specific objects are in which specific location in the game board.

An example of coins that may be used is specialized POKÉMON® coins. These coins each contain an RFID tag IC and antenna. One of the play patterns involves having an audio response when a user puts a coin down or flips a coin. For example, when a player puts a Mew coin, the speaker projects "Mew!" When a Pikachu coin is flipped into the board, the user hears "Pika!." When a user flips a coin, the user hears "Hooray!"

The play pattern may also be such that within the game, each coin grows up and gets special powers

permanently. This can be done by reading and updating the RFID read/write tag ICs of appropriate coins.

For example, special powers may be added or increased if the experience points of the coin reach a certain predetermined value. This value is controlled by the game program.

During the start of the game or the new introduction of coins in the game, the coins, for example, are updated with initial value, such as initial hit points, power points, and special points. During the course of the game, for example, if a coin is detected in the out of field zone 1614 (detected by an appropriate antenna placed in this area), hit points are decreased, for example, by ten points. When the hit points become zero, the coin "faints" or loses.

If a coin is detected by an antenna placed at or near the danger zone, sound effects may also be played. Variations on different board games play pattern rules and design may be implemented using the features of the inventions described herein.

In still another embodiment of the invention, a board game 1700 (Fig. 17) has a number of RFID tag ICs 1722 placed within the board identifying locations, letters, shapes, pictures, symbols, depictions, animals, fruits, or whatever is desired in the play pattern of the game. The play pattern of this game, for example, is the placing of hand-held units, such as three-dimensional items or tokens 1704, 1702 over or near the printed pictures 1720 on the board 1730. This could be used as part of a guessing game, an adventure game, a role-playing game, and any other play pattern desired.

These hand-held three-dimensional items or detectors 1704, 1702 are used to interact or play with the board and act as master/host/server units. Each three-dimensional detector 1704, 1702 generally includes an RFID reader/interrogator 1712, an antenna 1714, a processor, a program controlling the processor, and a speaker to project sound, speech, and sound effects. Each detector functions as a master unit such that placing or moving the item over a board location triggers the detector to respond with programmed sounds, music, and the like.

An RFID tag IC 1722 and an antenna 1724 are present underneath each printed depiction to identify the location or the picture. This way, when the detector master units 1702, 1704 are placed on the game board, the detectors can respond by saying if the tokens are placed in the correct locations. Variable play substance information, such as the number of times a detector is placed properly on a picture, is written into the memory associated with the RFID tag IC. In general, the detectors move about the game board and can detect tags at certain locations, thus affecting game play, variable play substance information, points, sounds, visual presentation (if available), and other play patterns of the game.

The present invention has been described above in terms of preferred embodiments so that an understanding of the invention can be conveyed. There are, however, many configurations, forms, play-pattern environments, rules and logic, and circuit designs for master/server/host toys and play objects, not specifically described herein but to which the present invention is still applicable.

The foregoing illustrates preferred embodiments of the invention by way of example, not by way of limitation. For example, the RFID reader/interrogator and/or the RFID tag may come from other manufacturers, the play-patterns modified to accommodate different set of play-patterns or game rules, the play objects are housed in different forms (e. g. toy lamp, toy desk, toy chair, etc.), a different set of play objects is used, information contained in the RFID tags differs from those described herein, the game board is different, or the user presentation differs from the one described herein. A person skilled in this field will recognize that such variations may exist without departing from the principles of the invention. The present invention should therefore not be seen as limited to the particular embodiments described herein, but rather should be understood to have wide applicability with respect to master/server/host toys and play objects. All modifications, variations, or equivalent arrangements and implementations that are within the scope of the attached claims should therefore be considered within the scope of the invention.

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The claims defining the invention are as follows:

1. A gaming device comprising:

a hand-held game/computing device having a processor and an interface connector for removably receiving an accessory device;

at least one play object having at least one remote digital non-self powered radio frequency identification (RFID) tag chip, each RFID tag chip having a data storage;

an accessory device comprising (a) at least one RFID reader/interrogator chip operably connected to the hand-held game/computing device, and usable with at least one play object, (b) a receiving connector/interface operably and removably connected to the game cartridge/pack, and (c) one or more control circuits interfacing a game cartridge/pack and the hand-held game/computing device; and

a game/cartridge pack containing a play program comprising one or more program components, said play program being capable of controlling said hand-held game/computing device and the accessory device.

2. The device of claim 1, wherein said RFID reader/interrogator chip being operable to receive instructions from said hand-held game/computing device processor under the control of said play program; and said instructions include instructions controlling said RFID reader/interrogator chip to read, write, and/or rewrite/update digital data in said data storage of said RFID tag chip.

3. The device of claim 1, wherein the receiving connector/interface is a pass-through interface between the game cartridge/pack and the hand-held game computing device.

4. The device of claim 1, wherein said at least one RFID reader/interrogator chip being operable to receive instructions from said processor under the control of said play program.

5. The device of claim 1, wherein said instructions from said processor include instructions controlling said RFID reader/interrogator chip to read, write, and/or rewrite/update digital data in said data storage of said RFID tag chip.

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6. The device of claim 1, wherein said play program comes from a readable medium or media read and loaded by said game/computing device to control said processor.

7. The device of claim 1, wherein said connector/interface is plugged into an interface provided by said game/computing device.

8. An accessory device for use with a hand-held game/computing device, said device being substantially as hereinbefore described with reference to any one or more of the embodiments as that embodiment is shown in the accompanying drawings.

DATED this Thirteenth Day of October, 2006

4Kids Entertainment Licensing, Inc.

Patent Attorneys for the Applicant

SPRUSON & FERGUSON

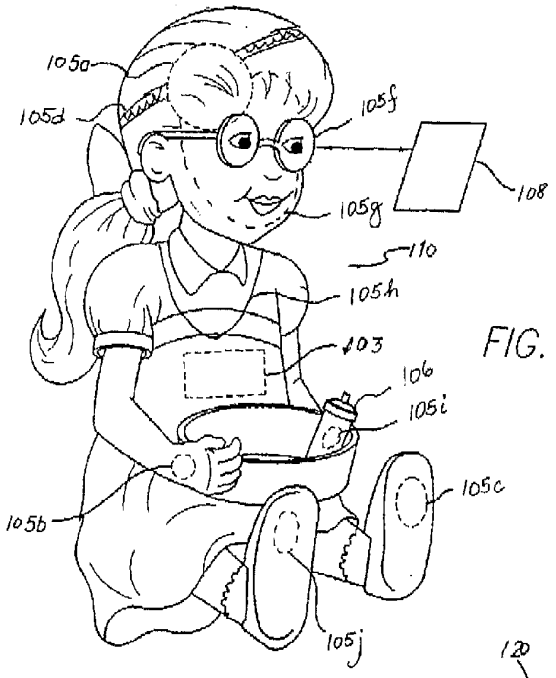

105a
105d
105f
108
105g
110
105h
103
106
105i
105c
105b
105j

FIG. 1A

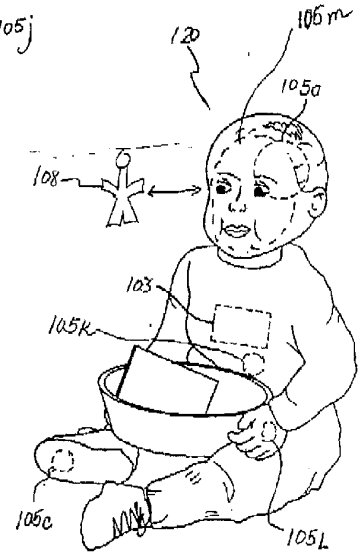

120
105m
105a
108
103
105k
105c
105L

FIG. 1B

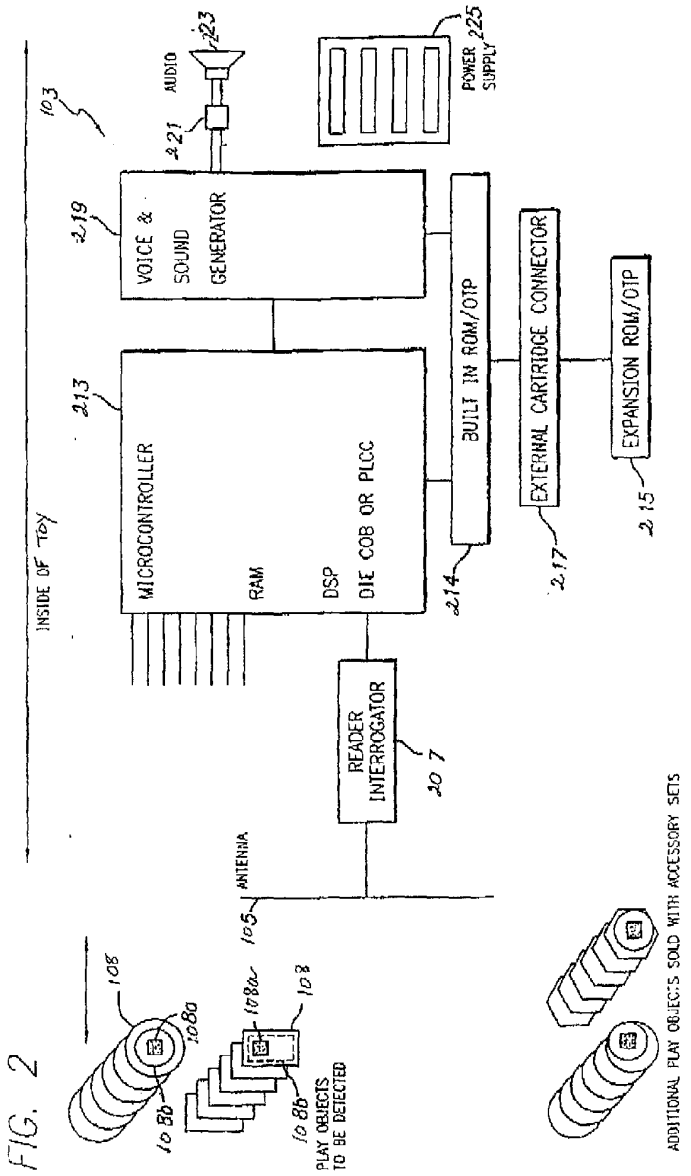

INSIDE OF TOY
103
AUDIO
123
421
POWER SUPPLY
225
219
VOICE & SOUND GENERATOR
213
MICROCONTROLLER
RAM
DSP
DIE COB OR PLCC
BUILT IN ROM/OTP
214
EXTERNAL CARTRIDGE CONNECTOR
217
EXPANSION ROM/OTP
215
READER INTERROGATOR
207
ANTENNA
105
108
108a
108b
PLAY OBJECTS TO BE DETECTED
ADDITIONAL PLAY OBJECTS SOLD WITH ACCESSORY SETS

FIG. 2

2/19

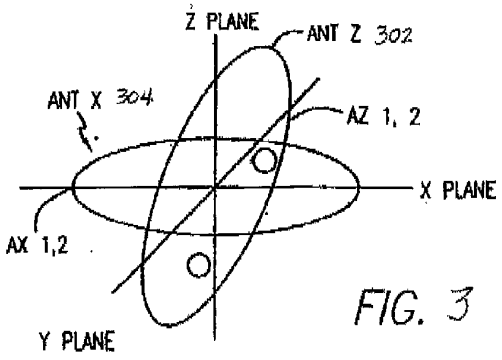

Z PLANE
ANT Z 302
ANT X 304
AZ 1, 2
X PLANE
AX 1,2
Y PLANE

FIG. 3

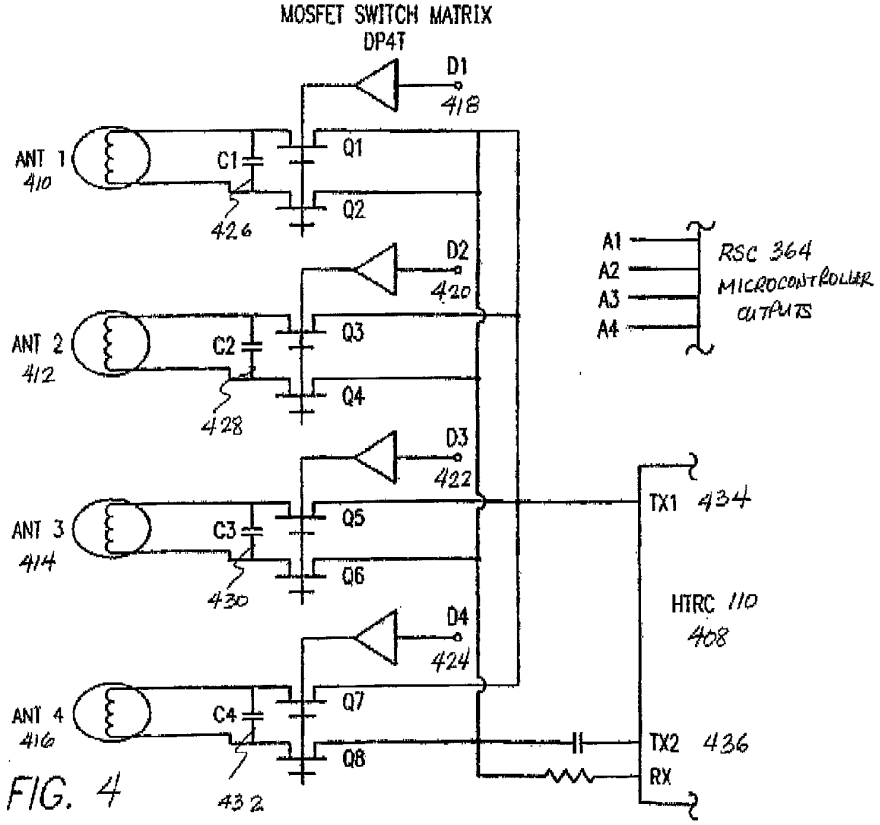

MOSFET SWITCH MATRIX
DP4T
D1
418
ANT 1
410
C1
Q1
Q2
426
D2
420
ANT 2
412
C2
Q3
Q4
428
D3
422
ANT 3
414
C3
Q5
Q6
430
D4
424
ANT 4
416
C4
Q7
Q8
432
A1
A2
A3
A4
RSC 364
MICROCONTROLLER
OUTPUTS
TX1 434
HTRC 110
408
TX2 436
RX

FIG. 4

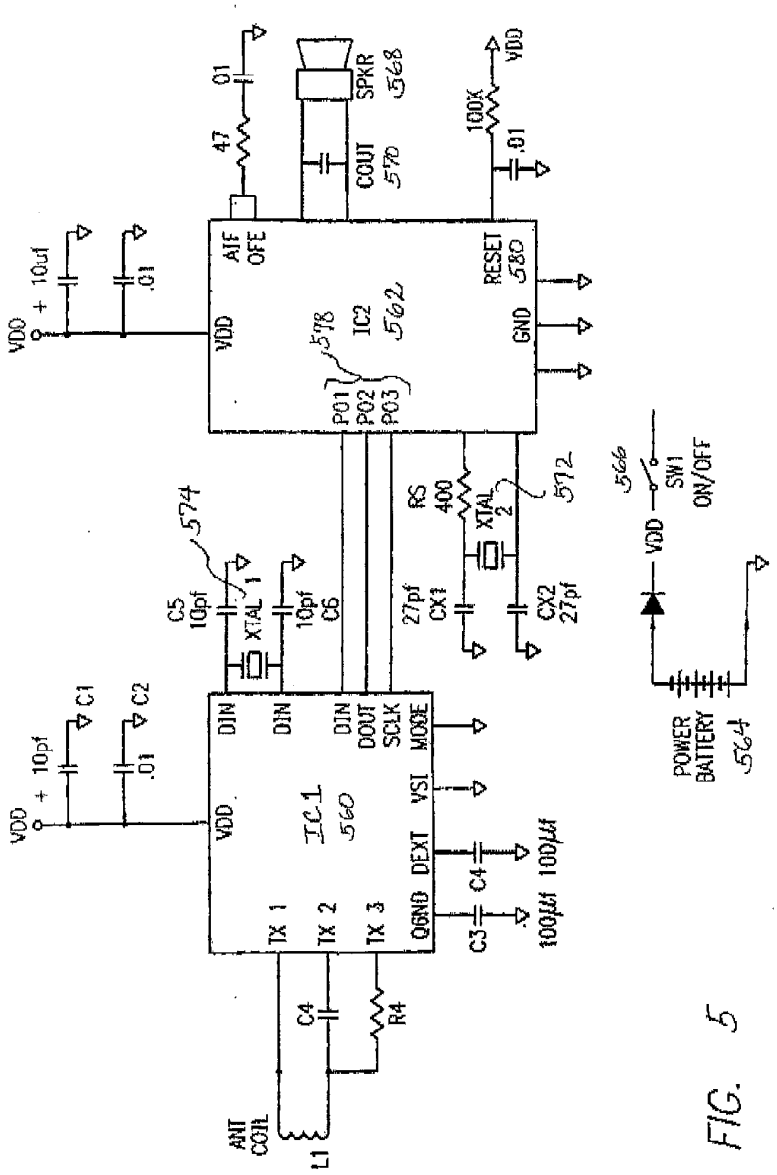

VDD
+ 10uf
.01
AIF
OFE
VDD
IC2
562
578
P01
P02
P03
RESET
580
GND
47
.01
SPKR
568
COUT
570
100K
VDD
.01
574
C5
10pf
XTAL 1
10pf
C6
RS
400
XTAL 2
572
27pf
CX1
CX2
27pf
566
SW1
ON/OFF
VDD
POWER
BATTERY
564
C1
C2
+ 10pf
.01
VDD
DIN
DIN
DIN
DOUT
SCLK
MODE
VSI
DEXT
QGND
IC1
560
TX 1
TX 2
TX 3
C4
100µH
C3
100µH
C4
R4
ANT
COIL
L1

FIG. 5

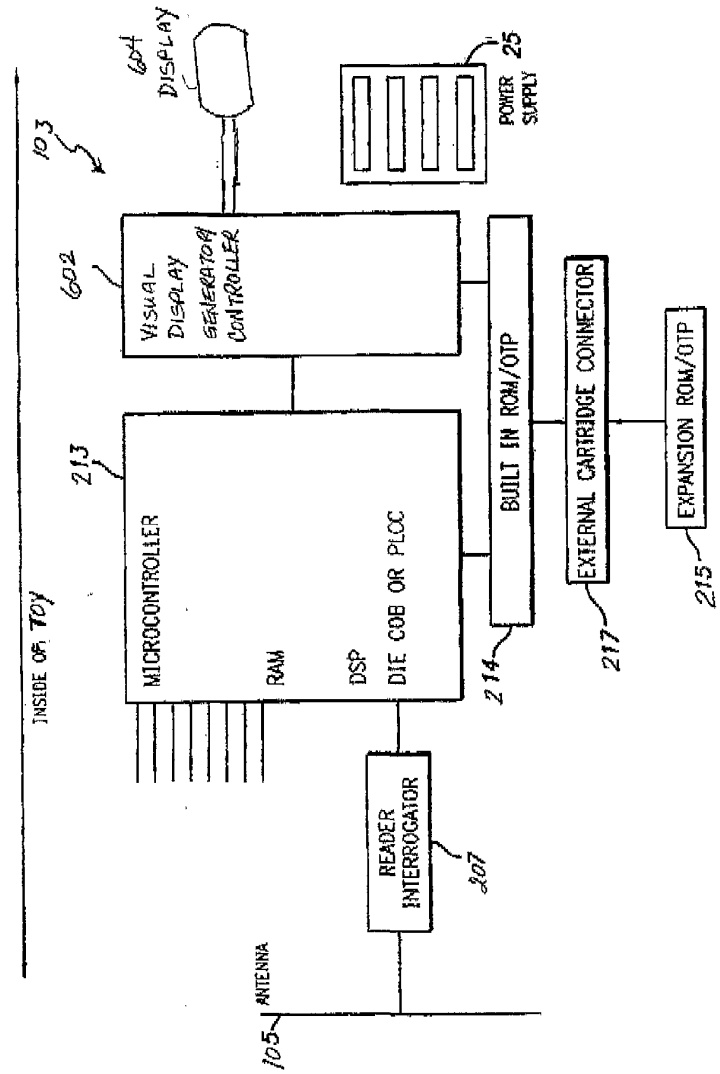
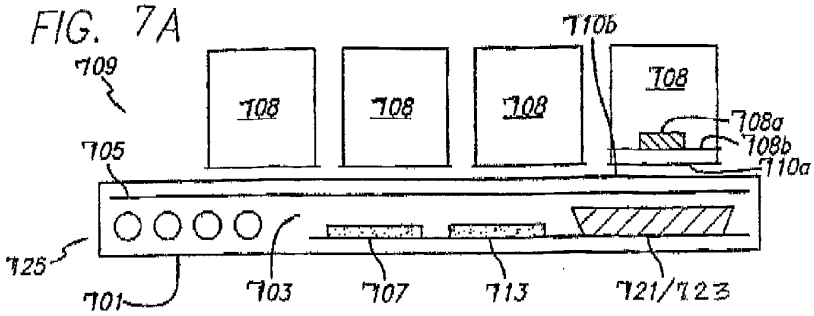

INSIDE OF TOY
103
604
DISPLAY
602
VISUAL DISPLAY GENERATOR/ CONTROLLER
25
POWER SUPPLY
213
MICROCONTROLLER
RAM
DSP
DIE COB OR PLCC
214
BUILT IN ROM/OTP
217
EXTERNAL CARTRIDGE CONNECTOR
215
EXPANSION ROM/OTP
207
READER INTERROGATOR
105
ANTENNA

FIG. 6

FIG. 7A



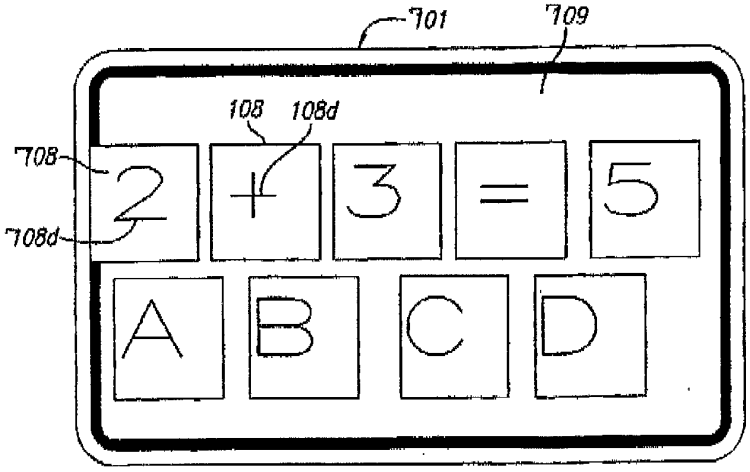
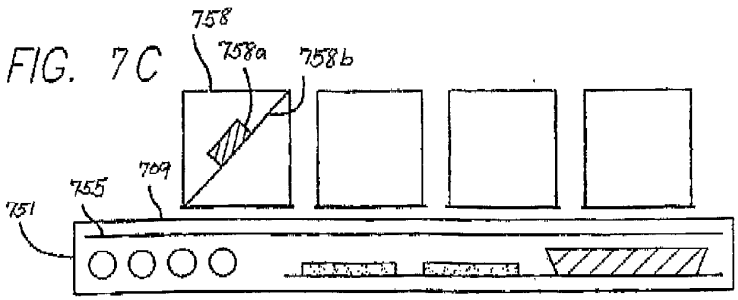


FIG. 7B

FIG. 7C



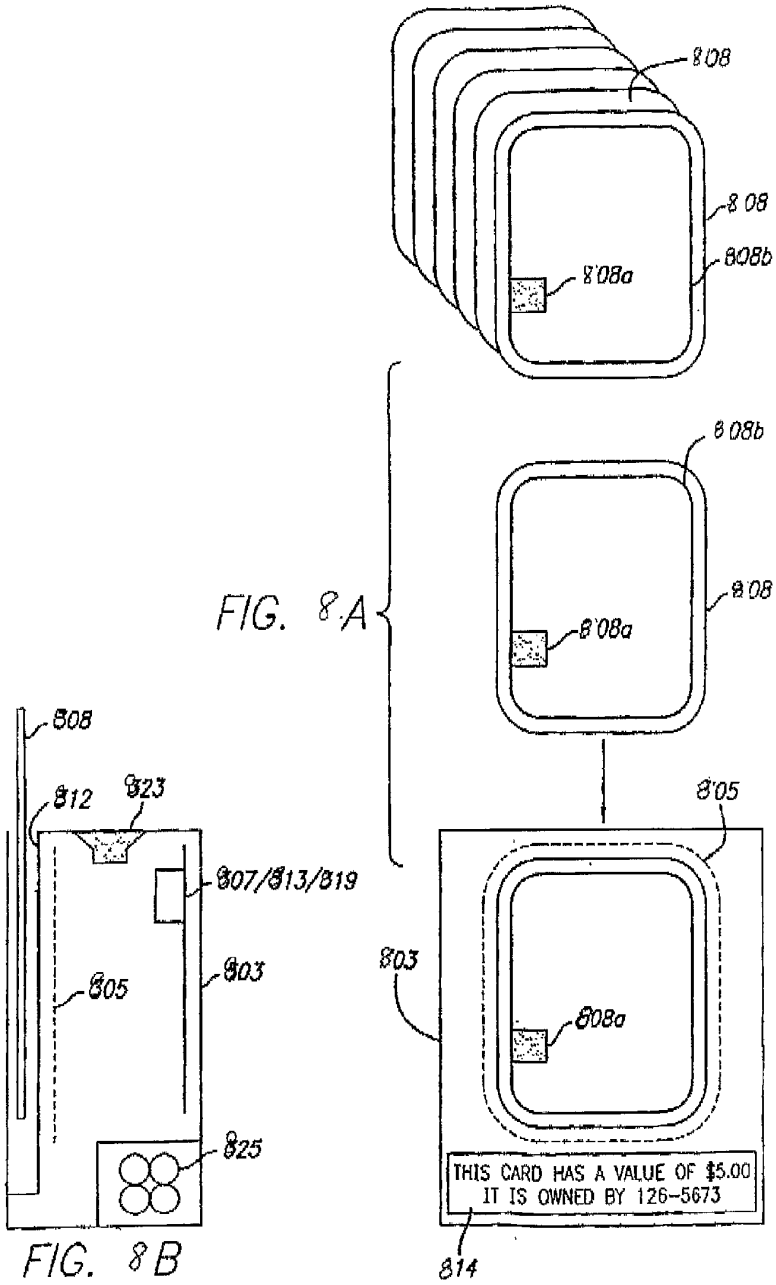

808
808
808b
808a
808b
808
808a
805
803
808a
THIS CARD HAS A VALUE OF $5.00
IT IS OWNED BY 126-5673
814
808
812
823
807/813/819
805
803
825

FIG. 8A

FIG. 8B

FIG. 9A

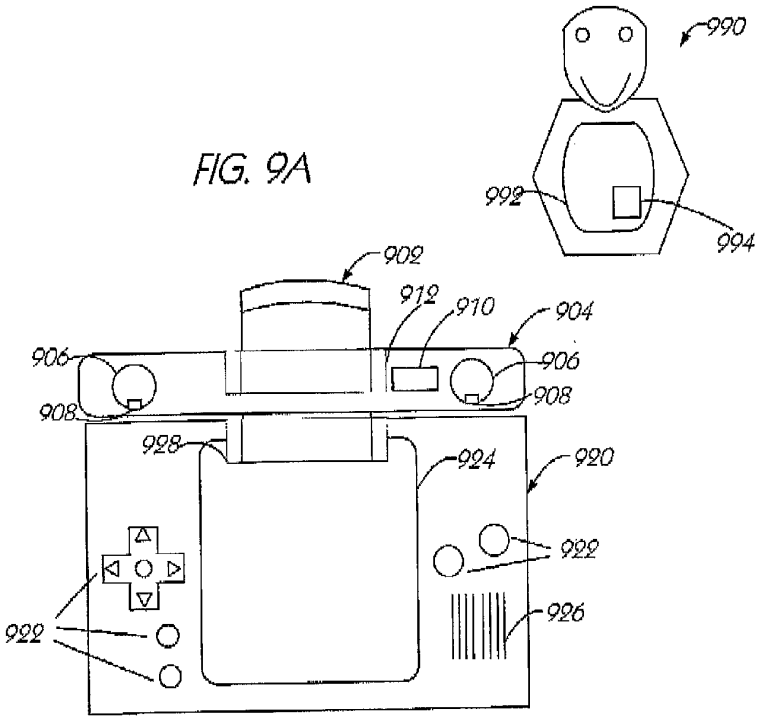

990
992
994
902
912
910
904
906
906
908
908
928
924
920
922
922
926

FIG. 9B

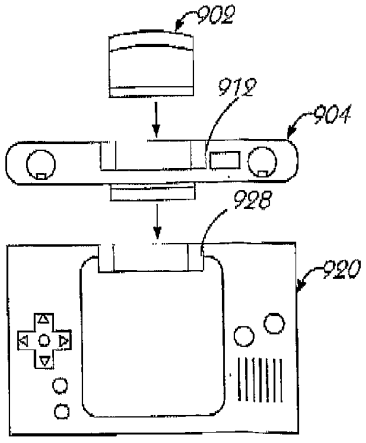

902
912
904
928
920

FIG. 9C

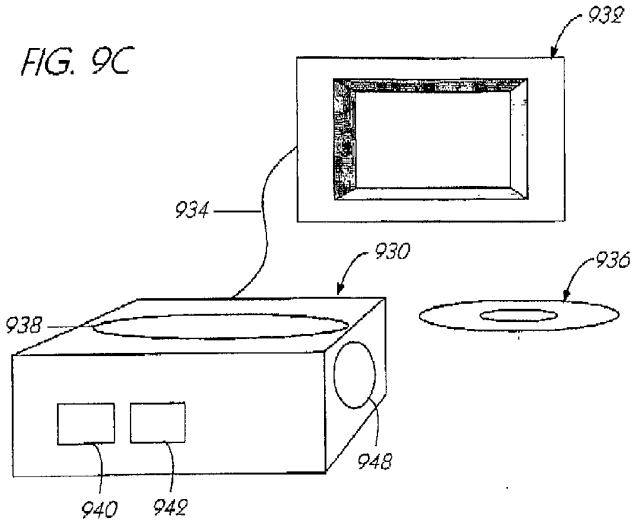


FIG. 9D

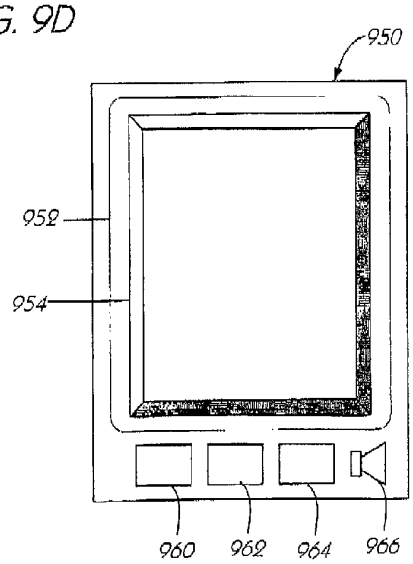


FIG. 10A

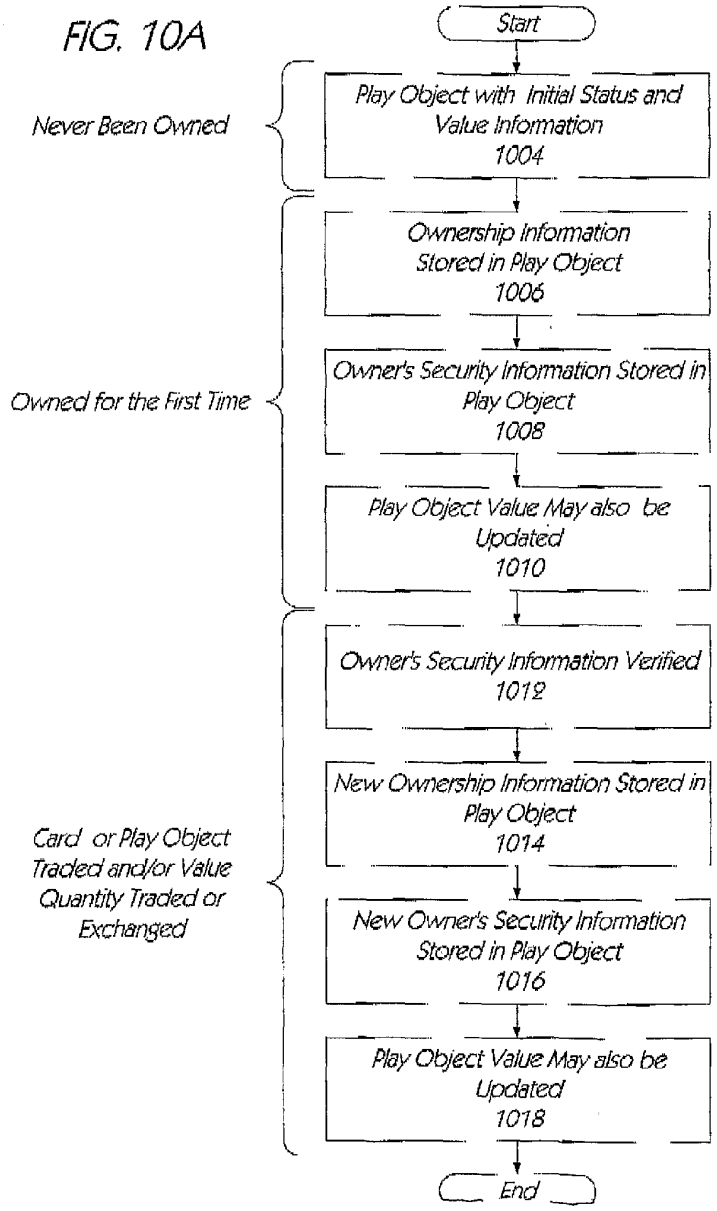

Start
Never Been Owned
Play Object with Initial Status and Value Information
1004
Owned for the First Time
Ownership Information Stored in Play Object
1006
Owner's Security Information Stored in Play Object
1008
Play Object Value May also be Updated
1010
Card or Play Object Traded and/or Value Quantity Traded or Exchanged
Owner's Security Information Verified
1012
New Ownership Information Stored in Play Object
1014
New Owner's Security Information Stored in Play Object
1016
Play Object Value May also be Updated
1018
End

FIG. 10B

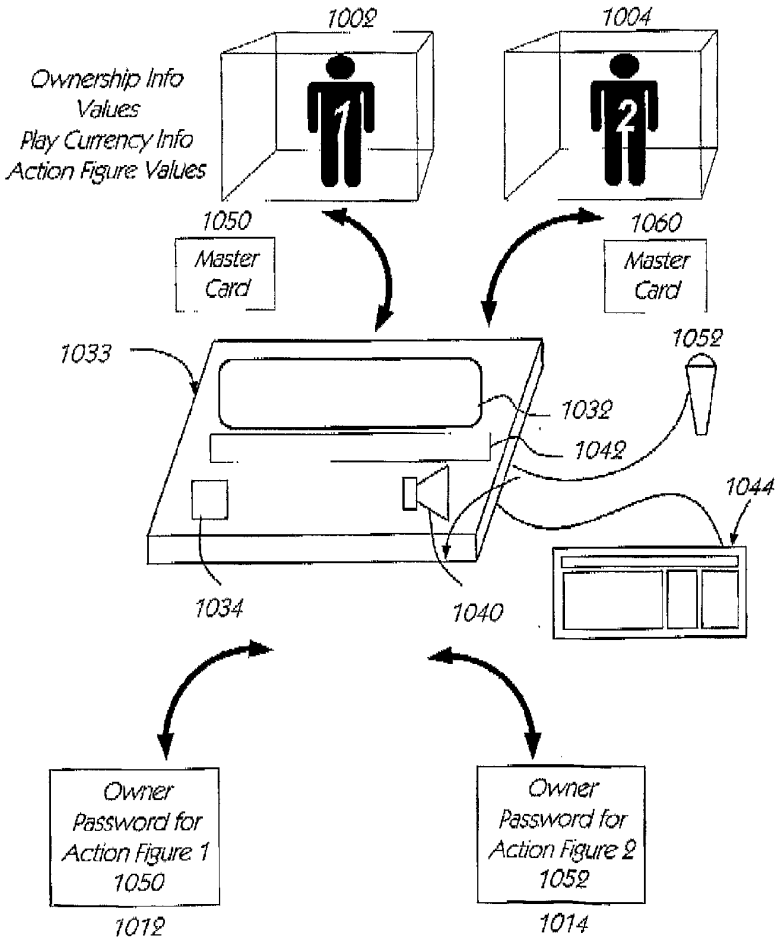

1002
1004
Ownership Info
Values
Play Currency Info
Action Figure Values
1
2
1050
Master Card
1060
Master Card
1033
1052
1032
1042
1044
1034
1040
Owner Password for Action Figure 1 1050
1012
Owner Password for Action Figure 2 1052
1014

FIG. 11

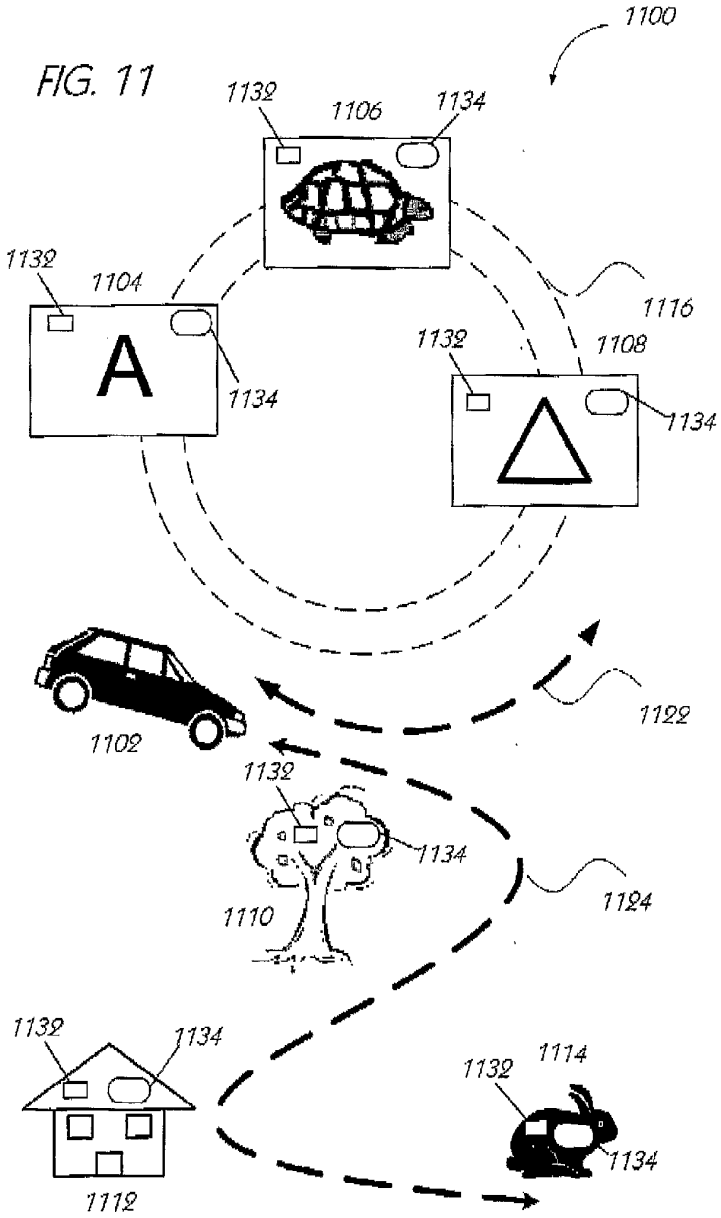

1100
1132
1106
1134
1132
1104
A
1134
1116
1132
1108
1134
1102
1122
1132
1134
1110
1124
1132
1134
1132
1114
1134
1112

FIG. 12A

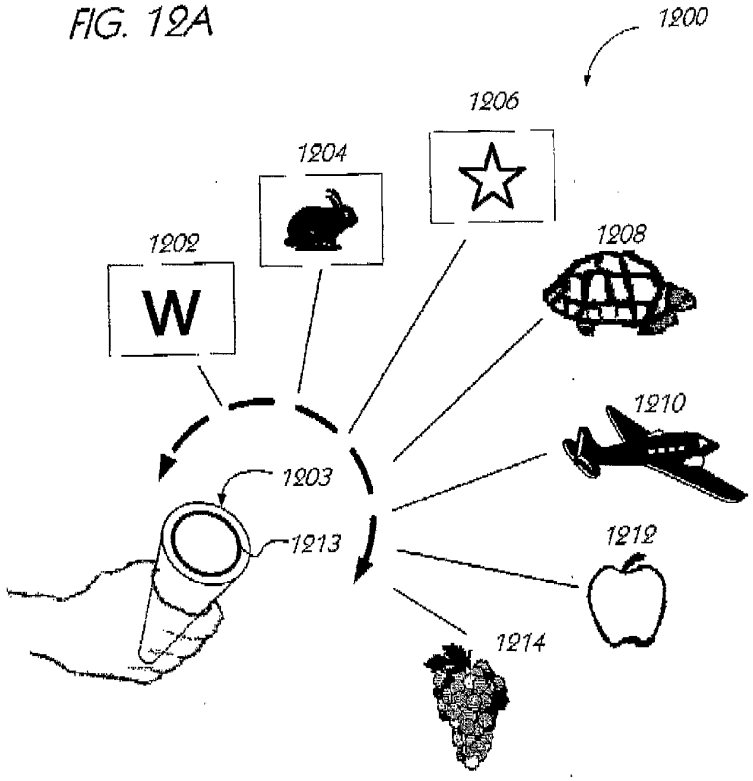


FIG. 12B

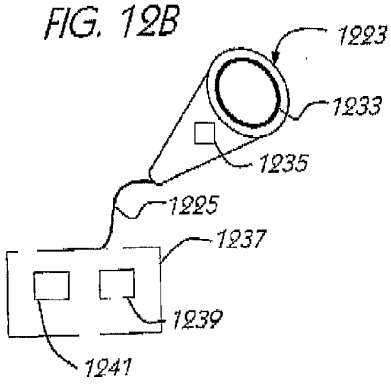


FIG. 12C

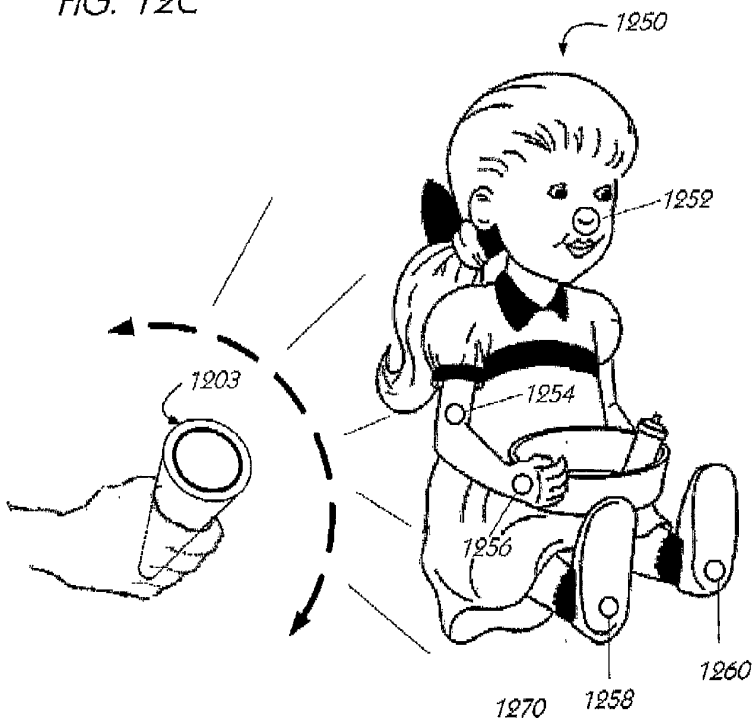


FIG. 13

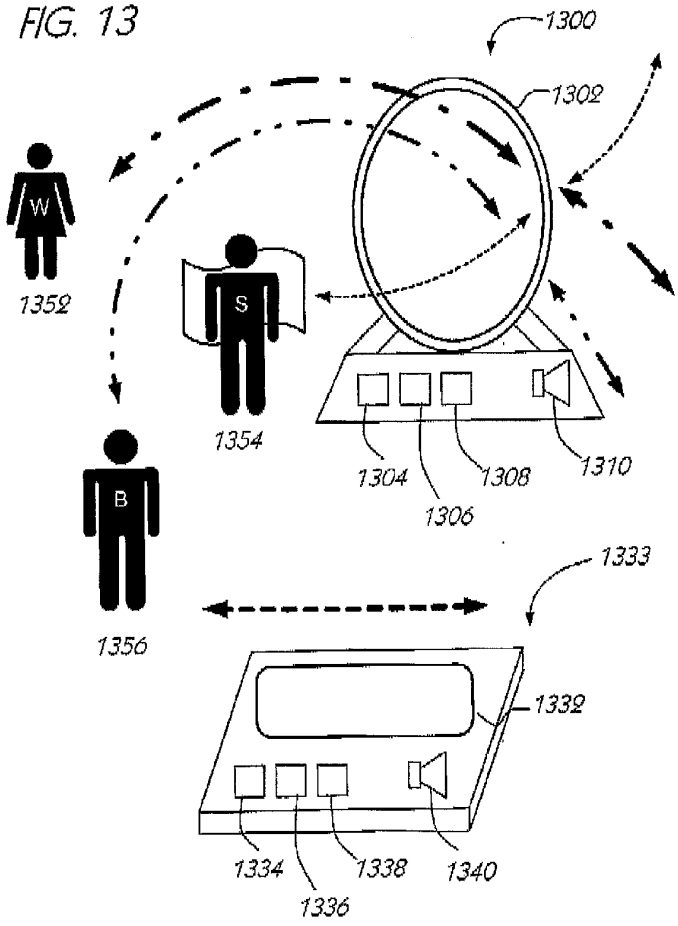

1300
1302
W
1352
S
1354
B
1356
1304
1306
1308
1310
1333
1332
1334
1336
1338
1340

FIG. 14A

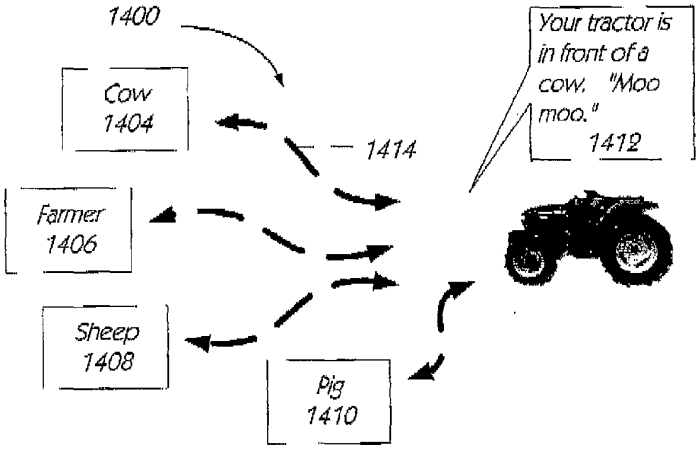


FIG. 14B

FIG. 14C

FIG. 14D

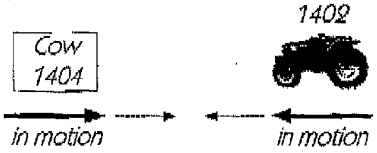
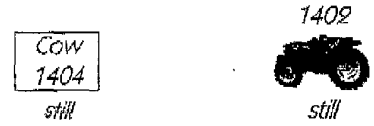


FIG. 14E



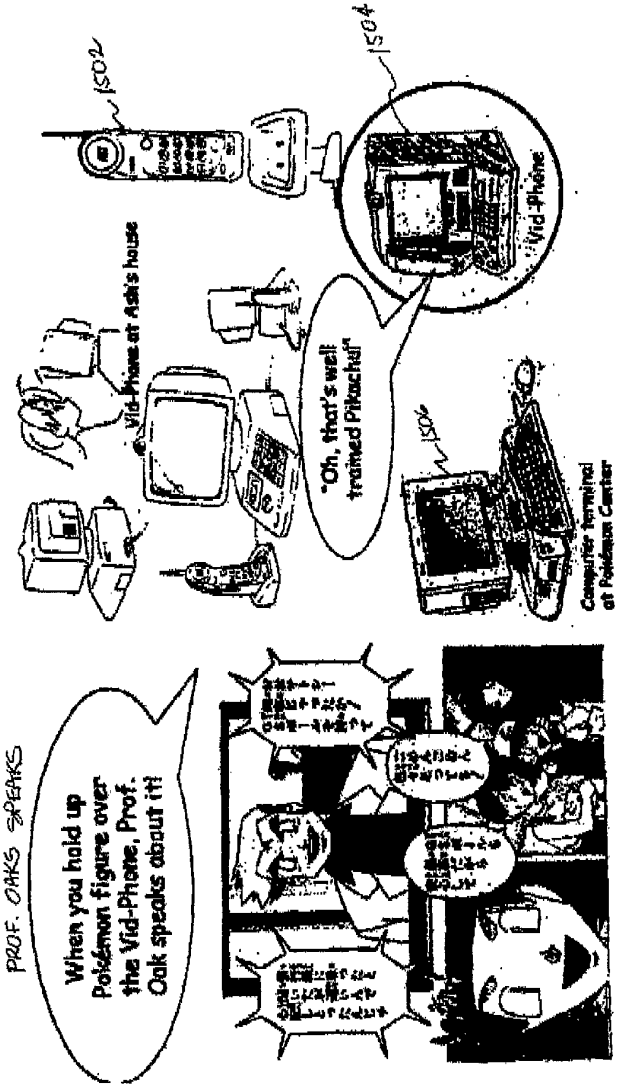

- Professor Oak's Vid-Phone -
PROF. OAK'S SPEAKS
When you hold up Pokémon figure over the Vid-Phone, Prof. Oak speaks about it!
Vid-Phone at Ash's house
"Oh, that's well trained Pikachu!"
Vid-Phone
Computer terminal at Pokémon Center
1502
1504
1506

FIG. 15

FIG. 16

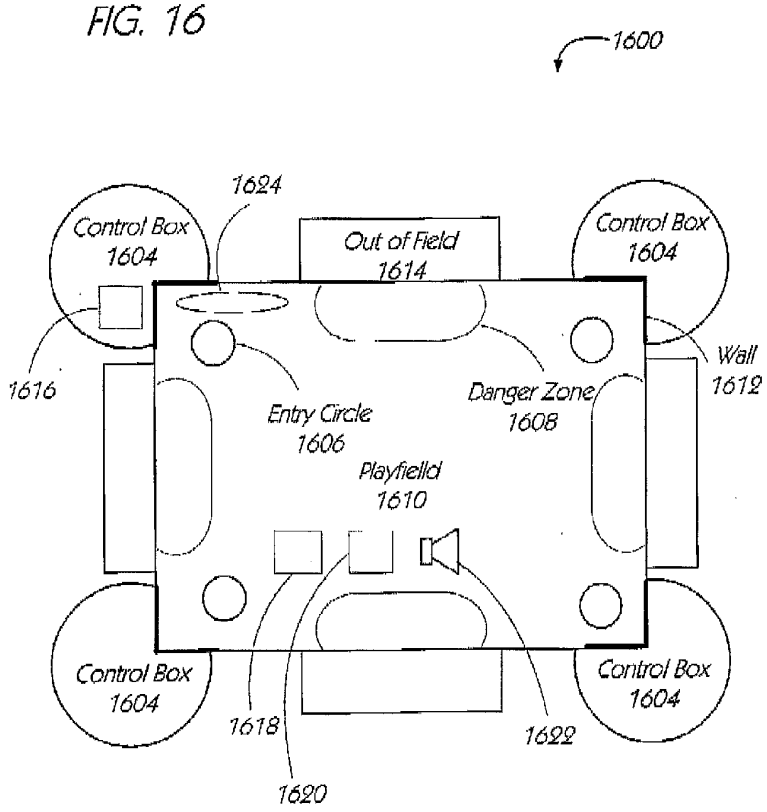

1600
1624
Control Box
1604
Out of Field
1614
Control Box
1604
1616
Entry Circle
1606
Danger Zone
1608
Wall
1612
Playfield
1610
Control Box
1604
Control Box
1604
1618
1620
1622

FIG. 17